

Frontend Technologies for Beginners



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Learner's Guide

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Preface

HyperText Markup Language (HTML) is the markup language popularly used by developers to design Websites. It is the language for the World Wide Web. It is used for building Websites that can be as large as a corporate Website or as small as a single page classroom project.

This book covers basic to advanced concepts of HTML5. The book begins with an explanation of basic HTML tags and attributes. It also explains the structure of Web pages using HTML. Then, it proceeds to explain the concept of Cascading Style Sheets (CSS). CSS is a technology that helps Website designers to provide a consistent formatting across large Websites by separating the content from its styles. Thus, CSS is used to control the look of the Web page by specifying the styles such as color, font, and font size for the HTML content. It can also be used to control the placement of items on a page. The book also explains JavaScript, which is a scripting language used for adding interactivity to Web pages. JavaScript allows programs in an HTML page to respond to user's actions. These responses could be validating the user's input, fetching and displaying the requested page, and so on. The book also covers explanations of jQuery and HTML5 mobile application support. jQuery is a short and fast JavaScript library that simplifies the client side scripting of HTML, animation, event handling, traversing, and developing AJAX based Web applications. The book concludes with a real-world case study based mini project.

The knowledge and information in this book is the result of the concentrated effort of the Design Team, which is continuously striving to bring to you the latest, the best and the most relevant subject matter in Information Technology. As a part of Aptech's quality drive, this team does intensive research and curriculum enrichment to keep it in line with industry trends and learner requirements.

We will be glad to receive your suggestions.

Design Team

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Session - 1

Introduction to the Web and HTML5

Welcome to the Session, **Introduction to the Web and HTML5**

This session explains the evolution, page structure, and features of HTML5. This session also introduces CSS, JavaScript, and jQuery. Finally, the session explains the browser support provided for HTML5. This session explains basic tags that are present in HTML5. This session also lists different data types, attributes, and entities of HTML5. Finally, the session explains advantages of using HTML5 in mobile application development.

In this Session, you will learn to:

- ➔ Explain evolution of HTML
- ➔ Explain the page structure used by HTML
- ➔ List new features of HTML5
- ➔ Explain CSS
- ➔ Explain JavaScript
- ➔ Explain jQuery
- ➔ Explain browser support for HTML5
- ➔ Explain elements constituting an HTML tag
- ➔ Describe DOCTYPE declarations
- ➔ Explain the basic tags in HTML
- ➔ List different data types, attributes, and entities of HTML5
- ➔ Describe container and standalone tags
- ➔ Explain the role of HTML5 in mobile devices

1.1 Introduction

HyperText Markup Language (HTML) was introduced in the year 1990. Since then, there has been continuous evolution in the technology leading to introduction of new versions. Some features were introduced in specifications, whereas others were introduced in software releases.

HTML 4 was recommended as a standard by W3C in 1997. HTML5 is the next version of HTML and will be the new standard. HTML 4.01 was the previous version of HTML which was released in 1999. Since then, there have been constant evolutions and additions to the World Wide Web (WWW). Majority of the browsers support HTML5 elements and Application Programming Interfaces (APIs).

1.1.1 Evolution of Computing

The era of computing started with the use of stand-alone computers to carry out different computing operations. These computers were isolated and not connected to each other.

Eventually as the years passed, the growth of computing expanded in multiple diverse fields such as business, education, and military due to quick data processing. With such a huge expansion, organizations felt the requirement of sharing the processed data among their people to save time and effort. This marked the beginning of computer networks. Organizations began to connect their computers and share data amongst their people. These networks are as follows:

- Local Area Network (LAN)
- Metropolitan Area Network (MAN)
- Wide Area Network (WAN)

LAN refers to a computer network in a small geographical area such as office, home, or school. MAN refers to a network that covers a city. WAN refers to a network that connects LANs and MANs across the globe.

Figure 1.1 shows the evolution of computing.

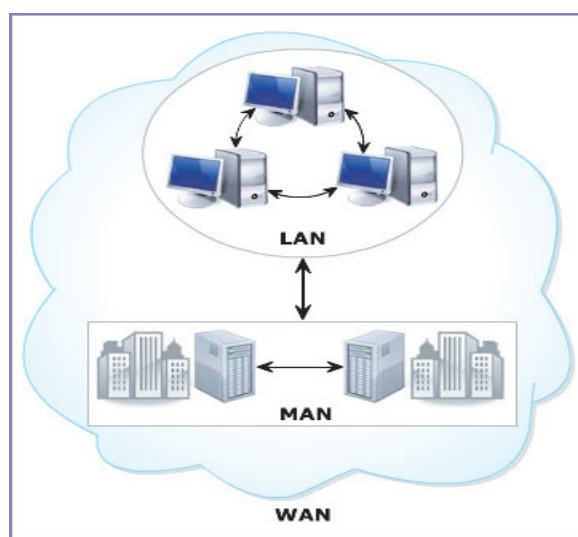


Figure 1.1: Evolution of Computing

1.1.2 Web and Internet

The advent of WANs raised a strong requirement to share data across the globe rather than just sharing the data within the organization. This is because organizations can share their problems, solutions, experiences, and updates along with other organizations and customers. This would facilitate faster analysis and decision-making process. This resulted in the evolution of the Web, also referred as World Wide Web or WWW. Therefore, Internet is known as the largest WAN.

The Web is a way to access information using the Internet that is referred to as a network of networks. Here, multiple computers are connected to each other irrespective of their geographical locations. Information is made available across the globe in the form of Web pages.

A Web page is a file that contains information and instructions to display information to the users. Figure 1.2 shows the relation between Web and Internet.

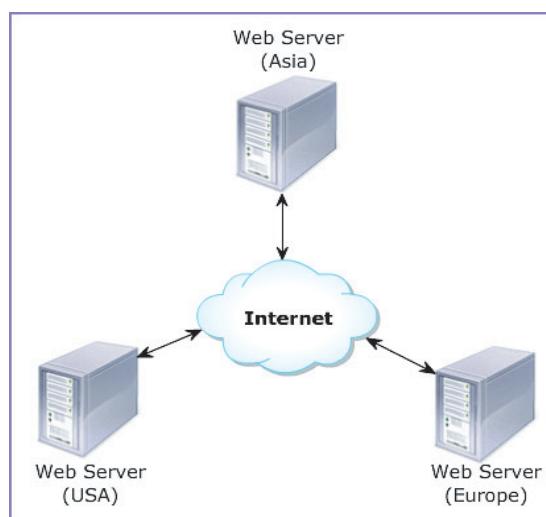


Figure 1.2: Web and Internet

1.1.3 Web Communication

Web pages are stored on a Web server to make them available on the Internet so that users can view them. A Web server is a computer with high processing speed connected to the Internet and is used to host Web pages. Web browsers such as Microsoft Internet Explorer or Google Chrome are used to interpret and display the Web pages using a protocol (set of rules). The most popular protocol used to view Web pages is Hypertext Transfer Protocol (HTTP). It is a protocol that specifies how a Web page will be retrieved from the Web server.

Steps to view a Web page in a browser are as follows:

1. The user specifies the Uniform Resource Locator (URL) of the Web page in a browser.
2. The client browser sends the URL request to the appropriate Web server.
3. The Web server processes the request and sends the Web page as a response to the browser as shown in Figure 1.3.

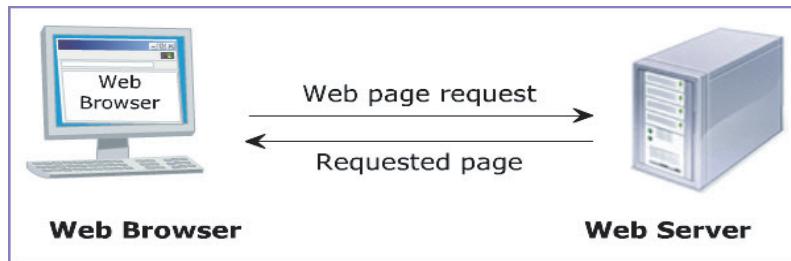


Figure 1.3: Web Communication

Note - A URL is a unique path of a Web page and it is in the form of [protocol]://[Web server name]/[path of the file to be searched].

1.1.4 Static Web Pages

Evolution of Web started with the creation of static Web pages. A static Web page consists of contents specified by the Web page designer. These contents include text, images, audios, and videos. The same content is displayed to each user on the Internet each time the page is requested.

Therefore, such a Web page is called a static Web page, as the contents of the Web page remain unchanged. The only way to update a static Web page is to change the content manually.

Static Web pages are developed using HTML. HTML is a language used to create Web pages that include hypertext along with other contents. Hypertext refers to the content in a Web page, which is linked to another Web page. Advantages of static Web pages are as follows:

- Simple to design as it does not provide interactivity. This leads to reduction in programming effort and complexity of Web pages.
- Ideal for specifying content appearance as static Web pages focus on content presentation, which is one-way flow of information.

1.1.5 Dynamic Web Pages

Static Web pages are easy to design and develop but they have few limitations. Firstly, static Web pages are difficult to maintain, as they must be updated manually. This raises the risk of inconsistency and incomplete content in static Web pages, which might make them unreliable. Secondly, they do not allow any user interaction. This means that users can only view and read the contents. These limitations led to the requirement of dynamic Web pages.

A dynamic Web page generates content 'on-demand' when user provides certain inputs. It accepts the inputs from the user based on which it displays the content in the browser. Consider an example of an online store where users can buy different products by selecting them online. Based on the selected products (input), a page with the total cost is displayed to the user.

1.1.6 Technologies

Dynamic Websites can include Web pages containing static as well as dynamic content. The main advantage of using dynamic Web page is that, it allows customizing the content and its appearance in

the browser. A dynamic Website interacts with the database to generate dynamic content. A database is a collection of organized data. This data can be stored and retrieved using the technologies used in creating dynamic Websites. Some of the technologies used for creating dynamic Websites are as follows:

→ **JavaScript**

JavaScript is a scripting language developed by Netscape for creating dynamic Web pages. It is used to develop interactive Web pages by adding programming to HTML.

→ **Cascading Style Sheets (CSS)**

CSS are style sheets that specify the formatting of a Web page for both static and dynamic Web pages. The formatting options include font, color, background, spacing, positioning, and borders. It is used in combination with JavaScript to format Web pages dynamically.

→ **Extensible HTML (XHTML)**

XHTML is a language that combines HTML with Extensible Markup Language (XML). XML allows defining your own data in a structured format, which can be displayed in any browser. When you use XHTML with JavaScript, the required user-defined data is displayed each time the Web page is loaded in the browser.

→ **Dynamic HTML (DHTML)**

Dynamic HTML (DHTML) uses JavaScript and CSS to make dynamic Web pages. It allows you to transform the look and feel of Web pages. It allows Web pages to respond to the user's actions and enables focus on the content changes in the browser.

1.2 *History*

HTML is a markup language used primarily to create hypertext Web pages, which are published on the Web and displayed in any Web browser. A markup language is a set of notations that specifies how the content should look in the browser. HTML is derived from Standard Generalized Markup Language (SGML), which is the mother language of HTML. SGML is a markup language that defines the structure of other markup languages.

HTML has evolved over the years with the introduction of improved set of standards and specifications. HTML 1.0 was the first version of HTML introduced in 1993. At that time, there were very less people involved in designing Websites. HTML 2.0 was introduced in 1995 and included the complete HTML 1.0 specifications with additional features. Other versions are as follows:

→ **HTML 3.0**

HTML 3.0 specifications included new features for the Netscape Navigator browser as it became very popular. The new improvements did not work on any other browsers such as Internet Explorer. Therefore, this specification was abandoned.

→ **HTML 3.2**

Additional browser-specific features revolutionized the requirement for standardization of HTML. Therefore, the World Wide Consortium (W3C) organization was formed to specify and maintain the HTML standards. HTML 3.2 was the first specification introduced by W3C in January 1997 and was

fully supported by all the Web browsers.

→ **HTML 4.0**

W3C introduced HTML 4.0 in December 1997 with the motive for facilitating support for CSS, DHTML, and JavaScript. However, HTML 4.0 prevailed for a short period and was revised, which led to HTML 4.01 specification in 1999.

→ **HTML5**

HTML5 is cooperative project between the W3C and the Web Hypertext Application Technology Working Group (WHATWG).

W3C was busy working with XHTML 2.0 and WHATWG was working with Web forms, new HTML features, and applications. In 2006, the two groups decided to work together and develop a new version of HTML.

Some basic rules for HTML5 that were established are as follows:

- Introduction of new features should be based on HTML, CSS, DOM, and JavaScript
- More markup should be used to replace scripting
- HTML5 must be device independent
- Requirement for external plug-ins
- Better error handling capabilities
- Development process should be completely visible to the public

1.3 Layout of a Page in HTML5

The basic structure of a HTML5 document remains the same. Each HTML5 page consists of a head section containing unseen elements and links and a body section where the visible elements of the document are present.

HTML offers different tags to build and organize the content in the body of the document. The body structure generates the visible part of the document. One of the elements provided for body is `<table>` tag.

Tables help in improving user's experience by helping the user to visualize the Website in an organized manner. Eventually, other elements replaced the function of tables. These elements have lesser code and are faster, thus facilitating creation, portability, and maintenance of a HTML5 Website.

The `<div>` element was another element that was introduced in this field. With the integration of HTML, CSS, and JavaScript, and the usage of more interactive applications, the `<div>` tag was frequently used. Both the `<div>` and `<table>` elements, did not provide information about the sections of the body that the element may be representing. Content such as scripts, images, links, text, menus, forms, and so on could be used between the opening and closing `<div>` tags.

HTML5 includes new elements that identify and organize each part of the document body. In HTML5, the most significant sections of a document are separated and marked. Hence, the main structure does not

depend on the <div> or <table> tags.

A typical HTML page would have a page header, footer, and middle page content. Within the middle page content, at the top level, it may have navigation, content, and aside columns. Also, within the content, more sections can be embedded depending on the page's specific content.

Figure 1.4 shows the regular layout of a Web page in HTML5.

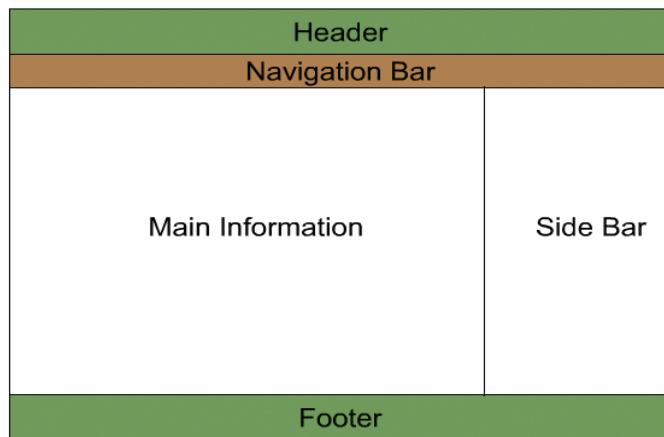


Figure 1.4: Layout of a Web Page in HTML5

The **Header** on the top usually has the logo, name, subtitles, and short descriptions of the Website or Web page.

After that is the **Navigation Bar** that includes a menu that contains links for navigation. Web users can navigate to different pages or documents using the navigation bar.

The most relevant content is generally shown in the middle of the page. The content presented in the **Main Information** part of the layout usually has a top priority. It can have a list of products, description of products, blogs, or any other important information.

The **Side Bar** shows a list of links that lead to certain items that may be present internally on the Website or on an external link. For example, in a blog, the last column offers a list of links that can lead to the blog entries, information about the author, and so on. These two sections are extremely flexible. Web designers can perform variety of actions, such as inserting more rows or splitting columns, to edit the Web page as required.

The **footer** at the bottom is used to represent general information about the Website. This can include the author or company name, links regarding rules, terms and conditions, location maps, and any other additional data.

1.4 New and More Flexible Approach of HTML5

HTML5 adds new capabilities to the previous version of HTML. It is a revised code build on the basis of HTML 4. HTML5 provides major improvement through better interactivity, multimedia services, and application handling. For example, you can directly play a video or audio on any browser without requiring to install external plug-ins.

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HTML5 can be useful to a Website developer, a game developer, or even an application developer. HTML5 has different aspects for everyone. Some of these aspects of HTML are as follows:

- ➔ For a multimedia person, HTML5 gets rid of plug-ins and uses new native support for audio and video.
- ➔ For a Web designer, HTML5 provides descriptive semantics.
- ➔ For a programmer, HTML5 helps to create rich Internet clients. These clients can be built without using plug-ins. For this, you can use canvas and JavaScript to create better interfaces and animations. Canvas is a rectangular area on the Web page that uses JavaScript. A developer can control each single pixel in the area. The canvas element has several ways to draw paths, rectangles, filled rectangles, circles, images, and so on.
- ➔ For a client-side programmer, Web workers is one of the features provided that can make JavaScript more efficient. Web workers is a JavaScript based API that is used to run background scripts in a Web application. This helps to mitigate effect of the background script affecting the main process that is being executed.
- ➔ For database administrator, HTML5 has client-side storage and caching functionality.
- ➔ For a design expert, CSS in HTML5 has been improved by added features such as advanced selectors, animations, drop-shadows, and so on.
- ➔ For a mobile programmer, a lot of features are included for building mobile applications.

HTML5 is a part of family of technologies that give whole new options for building Web pages and applications.

1.4.1 Working of HTML5

HTML consists of markup and improved CSS with CSS3 that provides added options to style your pages. There is also JavaScript and a new set of JavaScript APIs that are available in HTML5.

The process generally followed for HTML5 is as follows:

1. The browser loads the document, which includes HTML markup and CSS style.
2. After the browser loads the page, it also creates an internal model of the document that contains all the elements of HTML markup.
3. The browser also loads JavaScript code, which executes after the page loads.
4. The APIs give access to audio, video, 2D drawing with the canvas, local storage, and other technologies that are required to build apps.

1.5 New Features of HTML5

Some of the new features introduced in HTML5 are as follows:

- ➔ The <canvas> element is used for 2D drawing.

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- New content-specific elements, such as `<article>`, `<nav>`, `<header>`, `<footer>`, `<section>`, and so on help to structure the document.
- HTML5 has local storage support.
- The `<audio>` and `<video>` elements are available for media playback.
- New form controls, such as calendar, date, time, e-mail, URL, search, and so on have been provided by HTML5.
- The Web workers API is added to support background processes without disturbing the main process. The common problems faced by Web applications are slow performance when a large set of data is processed. This is due to the fact that all processes are executed in a single thread. Web workers help to solve this problem.
- The Web Sockets API provides a continuous connection between a server and a client by using a specific port. Thus, the Web applications become efficient as the data can be easily exchanged between client and server without reloading the page constantly.
- Easier access to location specific data which is made available by devices having Global Positioning System (GPS) capabilities. This improved functionality is achieved with the help of APIs.
- HTML5 allows Web applications to be executed offline by storing the files and other resources required in the application cache. Web application data is saved locally using Web SQL databases.

1.6 Cascading Style Sheets

HTML5 along with CSS and JavaScript forms an integrated instrument. CSS is basically a language that works along with HTML to provide visual styles to the elements of the document, such as size, color, backgrounds, borders, and so on.

A style sheet is a collection of rules that specifies the appearance of data in an HTML document. HTML is a markup language that focuses only on the layout of the content on a Web page. However, applying layouts to more than one occurrence of an HTML element in an HTML page is a tedious job.

For example, if you want to change the text in the H2 element to bold, this has to be done manually for all the H2 elements. Such a manual task might result into human errors such as missing an occurrence of the H2 element for applying the bold format. This results in format inconsistency among the H2 elements within an HTML page. Further, the specified formatting might not have same appearance across various devices such as computers and mobiles.

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Style sheets overcome these problems by specifying the formatting instructions in a separate file as shown in Figure 1.5.

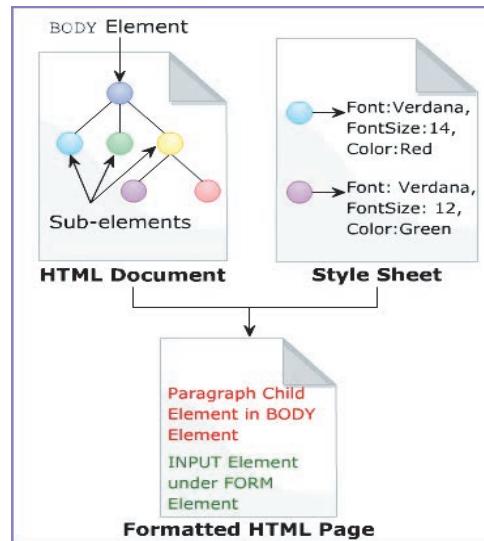


Figure 1.5: Requirement for Style Sheets

A CSS is a rule-based language, which specifies formatting instructions for content specified in an HTML page. Its purpose is to separate HTML content from its formatting so that Web page designers will not worry about formatting and layout. This is because they can define layout and formatting of the content in a separate file saved with an extension of .css. In the .css file, formatting instructions for an element are referred to as a rule set. Each rule defines how content specified within an element should be displayed in a Web browser.

While displaying the HTML page, the browser identifies the .css file for the page and applies rules for the specified elements. You can merge rules from different .css files or can edit them. This task of combining and matching rules from different files is referred to as cascading. Figure 1.6 shows an example of CSS.

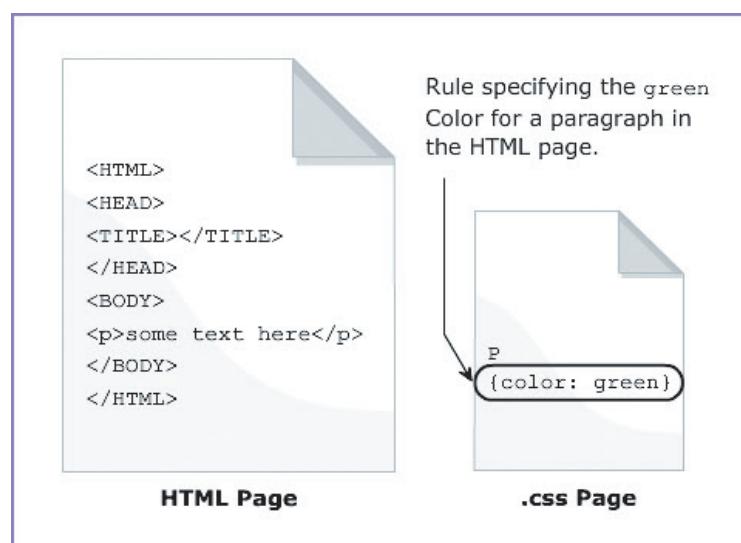


Figure 1.6: Example of CSS

1.6.1 Benefits of CSS

Multiple HTML pages can use a CSS document. CSS provides some useful benefits that make it an ideal choice to specify the appearance of content in an HTML page. These benefits are as follows:

- **Code Reusability:** CSS saves time by specifying formatting options of an element only once and applying them to multiple HTML pages.
- **Less HTML Code:** CSS helps in reducing file size of HTML documents by specifying formatting instructions in another file.
- **Device Independence:** CSS is designed for different devices to provide the same look and feel of the HTML page across them.

1.6.2 Working of CSS

You can embed the CSS code within the HTML code or link the HTML file externally to the CSS file. The browser will locate the style sheet irrespective of its location and will apply the style to the HTML page. There are certain steps involved in applying a style sheet to an HTML page. These steps are as follows:

1. The user requests for a Web page from the browser using the URL.
2. The server responds with the HTML file and related files such as image files, audio files, and external .css files, if any.
3. The browser executes the CSS code using the rendering engine and applies the styles to the HTML file.
4. The Web page is then displayed in the browser.

The rendering engine is a software that applies the formatting instructions to the Web page and displays the formatted content on the screen. Figure 1.7 shows the working of CSS.

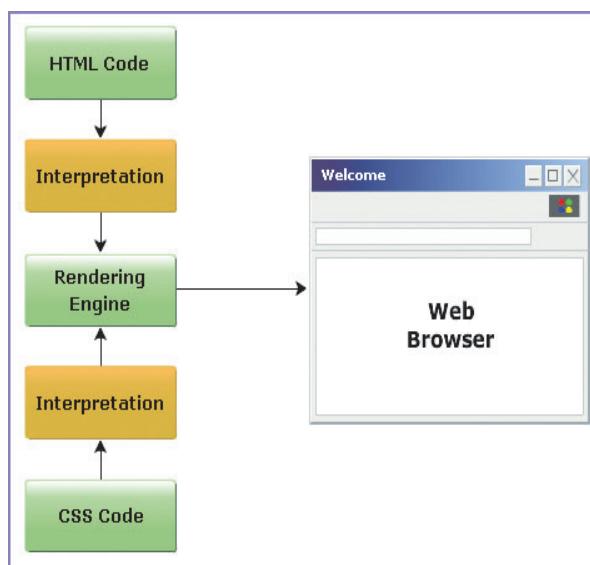


Figure 1.7: Working of CSS

1.7 JavaScript

JavaScript helps to build dynamic Web pages by ensuring maximum user interactivity. JavaScript is a scripting language that supports object-oriented programming style. This means that it provides objects for specifying functionalities. An object has a unique identity, state, and behavior.

JavaScript being a light-weight programming language is embedded directly into HTML pages. JavaScript is also free for use by all. It is the most popular scripting language and is supported by major browsers.

1.7.1 Functionality of JavaScript

JavaScript helps to include additional expression and functionality to your Web pages. Some of the tasks that can be performed using JavaScript and HTML5 are as follows:

- With HTML5 and JavaScript, you can create a 2D drawable surface in your page without using any plug-ins.
- Use Web Workers to turbo-charge JavaScript code to perform advanced computation or make an application more responsive.
- Access any Web service and bring that data back to your application in real time.
- No necessity for special plug-ins to play video.
- Create your own video playback controls using HTML and JavaScript.
- There is no requirement to use browser cookies as the browser local storage can be used.
- Use JavaScript to perform full video processing in the browser. You can also create special effects and even directly manipulate video pixels.

Besides the points mentioned JavaScript can also perform following functionalities:

- JavaScript helps Web designer to insert code snippets into the HTML pages without requiring to have in-depth programming knowledge.
- JavaScript can be used to execute events on certain user actions such as on click of a HTML element, page load, and so on.
- HTML elements can be manipulated by using JavaScript.
- The browser information of a Website visitor can be collected by using JavaScript.

1.8 jQuery

jQuery is a JavaScript library which is supported on multiple browsers. It simplifies the designing of client-side scripting on HTML pages. The jQuery library is based on modular approach that allows the creation of powerful and dynamic Web applications. The use of jQuery on HTML pages enable developers to abstract the low-level interaction code with pre-defined library developed on top of the JavaScript. This also helps to keep the client-side script short and concise.

Some of the features of jQuery library are as follows:

1. Easier to understand syntax that helps to navigate the document
2. Event handling
3. Advanced effects and animation
4. Developing AJAX-based Web applications

Note - AJAX is a development technique that is used to create asynchronous Web applications.

jQuery is a preferred library used by developers, as it is easy to understand. Also, features of jQuery enable development of rich Web applications in a shorter period.

1.9 Browser Support

Currently, no browsers have full HTML5 support as HTML5 keeps evolving.

However, the major browsers, such as Chrome, Firefox, Opera, Safari, Internet Explorer, and so on, are trying to add new HTML5 features to the latest versions of the browsers.

1.10 Introduction

All elements in HTML5 are organized using tags. The basic tags in HTML5 include `html`, `head`, `title`, `meta`, `link`, `script`, and `body`. The `DOCTYPE` must be provided before inserting basic tags in HTML5. There are different data types, attributes, and entities that can be applied to tags present in HTML5. All the tags are either classified into container tags or standalone tags. This classification is based on use of the end tag for a certain HTML element. HTML5 is also the preferred language for mobile application development because of its various benefits.

This session explains basic tags that are present in HTML5. This session also lists different data types, attributes, and entities of HTML5. Finally, the session explains advantages of using HTML5 in mobile application development.

1.11 Elements

An element organizes content in a Web page hierarchically, which forms the basic HTML structure. It consists of tags, attributes, and content. Tags denote the start and end of an HTML element.

A start tag includes an opening angular bracket (`<`) followed by the element name, zero or more space separated attributes, and a closing angular bracket (`>`). Attributes are name/value pairs that describe the element and content format. An end tag is written exactly as the start tag, but the forward slash (`/`) precedes the element name.

Figure 1.8 shows an element in HTML tag.

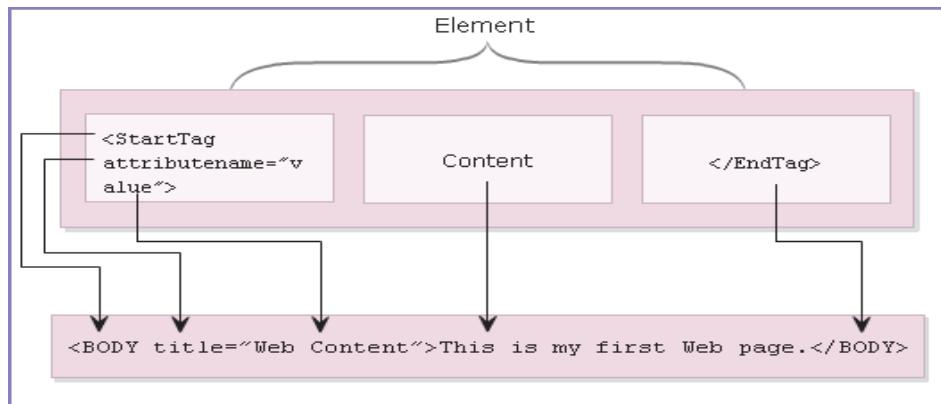


Figure 1.8: Element

Note - Tags are referred to as the markup in an HTML document.

1.12 Doctype

The DOCTYPE element informs the browser the HTML version number of your document. It is the first declaration in the HTML5 document before any other HTML code is written. By using a DOCTYPE, the browser is able to be more precise in the way it interprets and renders your pages. It is highly recommended to use a DOCTYPE at the beginning of all HTML documents.

The new HTML5 DOCTYPE declaration is as follows:

```
<!DOCTYPE html>
```

Not only is this syntax valid for the DOCTYPE for HTML5, but it is also the DOCTYPE for all future versions of HTML. This DOCTYPE is compatible even with older browsers.

Following example shows the use of the new document type specification.

Example:

```
<!DOCTYPE html>
```

1.13 Basic Tags

An HTML document is made up of different elements, tags, and attributes, which specify content and its format. Therefore, HTML is both a structural and presentational markup language. Structural markup specifies structure of the content, while the presentational markup specifies the format.

An HTML page is saved with the .html extension. The basic structure of an HTML document mainly consists of seven basic elements. These are as follows:

→ **HTML**

The HTML element is the root element that marks the beginning of an HTML document. It contains

the start and end tag in the form of `<HTML>` and `</HTML>` respectively. It is the largest container element as it contains various other elements.

→ **HEAD**

The `HEAD` element provides information about the Web page such as keywords and language used, which is not displayed on the Web page. Keywords are important terms existing in a Web page used by the search engines to identify the Web page with respect to the search criterion.

→ **TITLE**

The `TITLE` element allows you to specify the title of the Web page under the `<TITLE>` and `</TITLE>` tags. The title is displayed on the Title bar of the Web browser. The `TITLE` element is included within the `HEAD` element.

→ **META**

The meta tag is used for displaying information about the data. In HTML5, the content meta tag which was used for specifying the charset or character encoding has been simplified. The new `<meta>` tag is as follows:

```
<meta charset="utf-8" />
```

UTF-8 is the most commonly used character coding that supports many alphabets. UTF-8 is also being promoted as the new standard.

There are several other attributes associated with the meta tag that can be used to declare general information about the page. This information is not displayed in the browser. Meta tags provide search engines, browsers, and Web services the information that is required to preview or acquire a summary of the relevant data of your document.

In HTML5, it is not very important to self-close tags with a slash at the end. Though self-enclosing is recommended for compatibility reasons.

→ **LINK**

The `<link>` tag is used to define the association between a document and an external resource. It is used to link style sheets. Its `type` attribute is used to specify the type of link such as '`text/css`' which points out to a style sheet.

```
<link type="text/css" rel="stylesheet" href="first.css">
```

The `type` attribute is not included in HTML5. The reason is that CSS has been declared as the default and standard style for HTML5. So, the new link is as follows:

```
<link rel="stylesheet" href="first.css">
```

→ **SCRIPT**

With HTML5, JavaScript is now the standard and default scripting language. Hence, you can remove the `type` attribute from script tags too. The new script tag is as follows:

```
<script src="first.js"></script>
```

Following example shows the use of the script tag.

Example:

```
<!DOCTYPE html>
<html>
  <head>
    <meta charset="UTF-8">
    <title>HTML Webinar</title>
    <link rel="stylesheet" href="first.css">
    <script src="first.js"></script>
  </head>
</html>
```

→ BODY

The BODY element enables you to add content on the Web page specified under the `<BODY>` and `</BODY>` tags. Content can include text, hyperlinks, and images. You can display the content using various formatting options such as alignment, color, and background. Figure 1.9 shows the basic HTML elements.

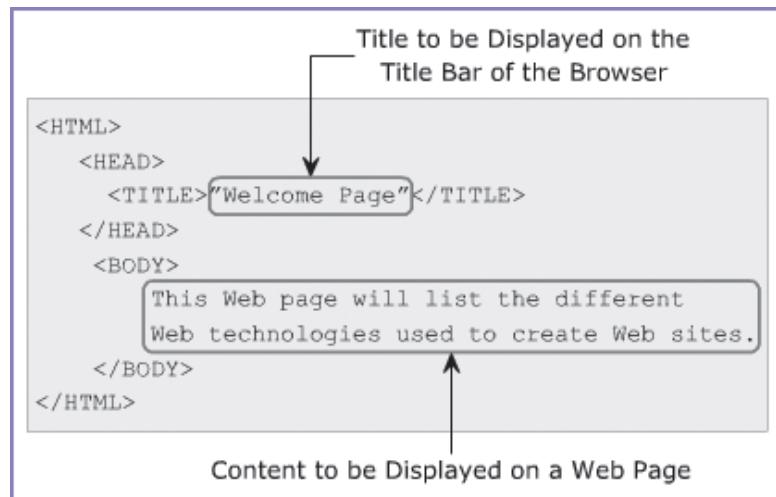


Figure 1.9: Basic HTML Elements

1.14 Data Types

A data type specifies the type of value assigned to the attributes and the type of content that is to be displayed on the Web page. Different types of content include text, images, hyperlinks, video, and audio. Data types help in identifying type of formatting such as color and length of data.

Important basic HTML data types are as follows:

→ Text Strings

Specifies textual content, which is readable by the user.

→ **Uniform Resource Identifiers (URIs)**

Specifies the location of Web pages or network files.

→ **Colors**

Specifies the color to be applied to the content on the Web page.

→ **Lengths**

Specifies the spacing among HTML elements. Length values can be in Pixels, Length, or MultiLength. Pixel refers to the smallest dot on the screen. Length is specified as a percentage value of Pixels or available space on the screen. MultiLength can be specified as Pixels or percentage.

→ **Content Types**

Specifies the type of content to be displayed on a Web page. Examples of content types include "text/html" for displaying text using HTML format, "image/gif" for displaying image of a .gif format, and "video/mpg" for displaying a video file of .mpg format.

Figure 1.10 shows different data types.

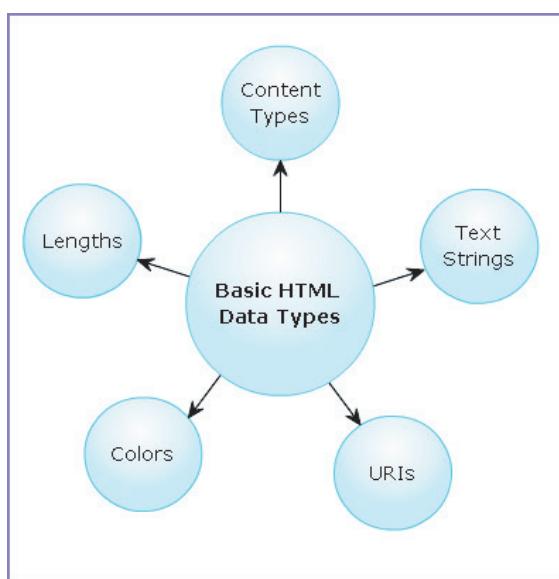


Figure 1.10: Data Types

1.15 Attributes

HTML attributes helps to provide some meaning and context to the elements. Some of the global attributes used in HTML5 elements are as follows:

→ **class** – Specifies classnames for an element.

→ **contextmenu** – Specifies the context menu for an element.

- **dir** – Specifies the direction of the text present for the content.
- **draggable** – Specifies the draggable function of an element.
- **dropzone** – Specifies whether the data when dragged is copied, moved, or linked, when dropped.
- **style** – Specifies the inline CSS style for an element.
- **title** – Specifies additional information about the element.

1.16 HTML Entities

Entities are special characters that are reserved in HTML. These entities can be displayed on a HTML5 Website using following syntax:

Syntax:

&entity_name;

OR

&#entity_number;

Table 1.1 shows some of the commonly used HTML entities.

Output	Description	Entity Name	Entity Number
	non-breaking space	 	
<	less than	<	<
>	greater than	>	>
&	ampersand	&	&
€	euro	€	€
©	copyright	©	©

Table 1.1: HTML Entities

1.17 Container and Standalone Tags

There are two types of HTML elements namely, container and standalone elements. A container element includes the start tag, contents, sub-elements, and end tag. All the basic HTML elements are container elements. A standalone element consists of the start tag and attributes followed by the end tag as /> without any content.

1.18 HTML5 and Mobile Devices

HTML5 has helped to create better and richer mobile applications. For this, APIs are used in HTML5. These APIs support advanced Web application features for mobile browsers.

HTML5 is not supported by older mobile devices. Smartphones with Apple iOS and Google Android as operating systems support HTML5 compliant browsers.

Due to various mobile platforms available on mobile devices, development of mobile applications is difficult. HTML5 has tried to integrate all the features to deploy mobile applications that would be compatible in all the platforms. HTML5 provides features such as drag-and-drop functionality, video embedding in an application, and even offline capabilities.

As HTML5 is compatible with most mobile operating systems, up to 30% of the cost for development for different operating systems is saved. Also, there is a reduced dependency in third-party components, thus reducing the licensing costs. All the required components will be readily available through the browser in HTML5.

1.18.1 Benefits of HTML5 for Mobile Development

Benefits of HTML5 for mobile developments are as follows:

- HMTL5 has included APIs, hence additional plug-ins are not required for mobile browsers.
- Mobile development is easier as knowledge of only HTML5, CSS, and JavaScript is majorly required. These are easier as compared to the other languages used for Mobile development. The development is also faster in HTML5.
- There is a rising growth for mobile applications and due to its enhanced compatibility, HTML5 forms the foundation for developing these mobile applications.
- HTML5 is compatible with most operating system platforms. The mobile applications developed on HTML5 can run on browsers of Android, iOS, Windows Mobile, and other mobile operating systems.
- The development cost for creating applications in HTML5 is low.
- Applications based on location and maps will have greater support in HTML5. The plan is to support such applications on browsers, hence, making them platform independent.
- Third-party programs are not required in HTML5. Hence, media functions such as audio and video have better functionality and improved support in HTML5.

1.19 Check Your Progress

1. HTML is a _____ language.

(A)	Markup	(C)	HyperMark
(B)	Markdown	(D)	MarkHyper

2. Which of the following statements about evolution of Web and dynamic Websites are true?

(A)	A Web server is a computer that allows you to make Web pages available on the Internet.
(B)	MAN is a computer network that covers a small area such as office or school.
(C)	HTTP is a protocol used for requesting Web pages over the Internet.
(D)	A Web browser is a software that processes user requests and responds with the requested page to the Web server.
(E)	A dynamic Web page is a Web page that can be created using CSS and JavaScript.

3. Which of the following is a new tag in HTML5?

(A)	Head	(C)	Body
(B)	Header	(D)	Title

4. Which of the following is a rule-based language?

(A)	CSS	(C)	JavaScript
(B)	jQuery	(D)	Geolocation

5. jQuery is a JavaScript library which is supported on _____ browsers.

(A)	Single	(C)	Dual
(B)	Multiple	(D)	Non-individual

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6. A _____ element includes the start tag, contents, sub-elements, and end tag.

(A)	Container	(C)	Emphasis
(B)	Standalone	(D)	Formatted

7. Which of the following DOCTYPE is used in HTML5?

(A)	HTML	(C)	Emphasis
(B)	Standalone	(D)	Formatted

8. What does URI stand for?

(A)	Uniform Resource Informer	(C)	Uniform Reply Identifier
(B)	Uniform Resource Identifier	(D)	Uniform Recourse Information

9. Which of the following attribute in HTML5 specifies text direction?

(A)	class	(C)	dir
(B)	contextmenu	(D)	style

10. Which of the following is the mobile-based operating system developed by Apple?

(A)	Symbian	(C)	Windows Mobile
(B)	iOS	(D)	Android

1.19.1 Answers

1.	A
2.	A, C, E
3.	B
4.	A
5.	B
6.	A
7.	A
8.	B
9.	C
10.	B

Summary

- HTML5 is cooperative project between the World Wide Web Consortium (W3C) and the Web Hypertext Application Technology Working Group (WHATWG).
- New features of HTML5 include tags such as <canvas>, <article>, <nav>, <header>, <footer>, <section>, <audio>, <video>, and so on.
- Some of the technologies used for creating dynamic Websites are JavaScript, CSS, XHTML, and DHTML.
- Cascading Style Sheet (CSS) is a rule-based language, which specifies formatting instructions for the content specified in an HTML page.
- JavaScript is a scripting language that allows you to build dynamic Web pages by ensuring maximum user interactivity.
- jQuery is a JavaScript library which is supported on multiple browsers. It simplifies designing of client-side scripting on HTML pages.
- Major browsers, such as Chrome, Firefox, Opera, Safari, Internet Explorer, and so on, have added new HTML5 features to their latest versions.
- An element organizes the content in a Web page hierarchically, which forms the basic HTML structure.
- The DOCTYPE element tells the browser the type of your document.
- A data type specifies the type of value assigned to the attributes and the type of content that is to be displayed on the Web page.
- Entities are special characters that are reserved in HTML.
- A container element includes the start tag, contents, sub-elements, and the end tag.
- A standalone element consists of the start tag and attributes followed by the end tag as /> without any content.
- HTML5 provides features such as drag-and-drop functionality, video embedding in an application, and even offline capabilities for mobile devices.

Try It Yourself

1. View the Website of Microsoft (<https://www.microsoft.com>).
2. Identify the header and footer on the Website.
3. Create a layout of the basic structure of the body of the Website.
4. Samantha wants to create a Website for her new Orchestra Group named **We Five**. She wants to design the Web page that will allow the search engine to get the required information. In order for the search engine to get the required information, the page should have following details:
 - a. Doctype – State the type of Doctype in the tag.
 - b. HTML
 - i. Head
 - ii. Title – Provide the name of the orchestra group in the tag.
 - iii. Meta – Provide keywords that would be applicable to the orchestra group Website.
 - c. Body – Provide a small introduction about the orchestra group in the body section.

Add any other additional content and other information as required.



Session - 2

Formatting Text and Using Hyperlinks and Anchors

Welcome to the Session, **Formatting Text and Using Hyperlinks and Anchors**.

This session explains different tags related to formatting of text. This session also explains different types of lists. Finally, the session explains the procedure to change the background of a Web page. This session explains hyperlinks and their absolute and relative paths. This session also explains the ways to hyperlink a Web page, e-mail address, or any other content. Finally, the session explains the procedure to create anchors on a Web page.

In this Session, you will learn to:

- ➔ Explain the Heading tag
- ➔ Explain different tags related to formatting
- ➔ Explain monospaced font, preformatted text, and block quotation
- ➔ Describe different types of lists
- ➔ Explain the procedure to change the background color and image
- ➔ Describe hyperlinks
- ➔ Explain absolute and relative paths
- ➔ Explain how to hyperlink to a Web page and e-mail address
- ➔ Explain how to hyperlink to anchors and other content

2.1 Introduction

The text content of the Web page forms an important part of a Website. This text content must not only be informative, but also attractive. It must be easy to read and have short and crisp sentences for easy understanding of users. To attract attention of the user, headings must be appropriately provided. Also, text formatting options such as bold, italics, subscript, superscript, and so on must be applied on the text. Bullets can be also used to list the text in a systematic manner. The background color and background image of a Web page can be specified using HTML.

2.2 Headings

The heading elements define headings for contents such as text and images. They specify a hierarchical structure of a Web page by grouping the contents into different headings.

HTML defines six levels of heading that ranges from H1 to H6. The H1 element specifies top-level heading, which is displayed with the largest size. The H6 element specifies lowest-level heading, which is displayed with the smallest size.

Code Snippet 1 demonstrates how to specify six levels of heading in an HTML page.

Code Snippet 1:

```
<!DOCTYPE html>
<html>
    <head>
        <title>Headings</title>
    </head>
    <body>
        <h1>H1 Heading</h1>
        <h2>H2 Heading</h2>
        <h3>H3 Heading</h3>
        <h4>H4 Heading</h4>
        <h5>H5 Heading</h5>
        <h6>H6 Heading</h6>
    </body>
</html>
```

The heading under the H1 tags will be displayed with the largest size. Each subsequent heading will be displayed in a size lower than its previous heading.

The heading under the H6 tags will be displayed with the lowest size. Figure 2.1 shows different types of headings.

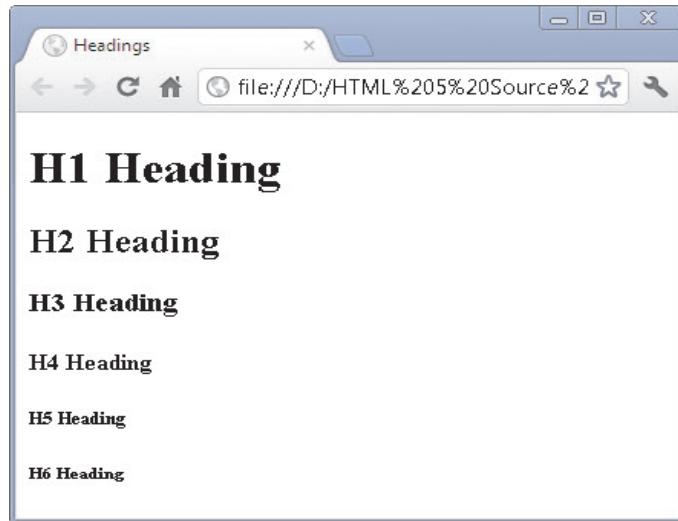


Figure 2.1: Different Types of Headings

2.2.1 HGROUP

The `<hgroup>` element is a new element defined in HTML5. It is used to group titles and their subtitles. The element is used to group a set of h1–h6 elements. These are used for headings that have multiple levels that can include subheadings, alternative titles, taglines, and so on. The main advantage of using the `<hgroup>` tag is to create a document outline. Code Snippet 2 shows the use of the `<hgroup>` tag.

Code Snippet 2:

```
<hgroup>
  <h1>Title of Post One </h1>
  <h2>Subtitle of Post One </h2>
</hgroup>
```

2.3 Formatting

The content format determines how the content will appear in the browser. For example, when you visit a Website, some text appears in a specific format such as bold or underlined. This means that the formatted content makes an HTML page look readable and presentable. In HTML, formatting is applied to the text by using formatting elements, which are container elements.

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Commonly used HTML formatting elements are as follows:

→ **B**

The **B** element displays text in bold. The text that must be displayed in bold is enclosed between **** and **** tags.

→ **I**

The **I** element displays text in italic. The text that must be displayed in italic is enclosed between **<i>** and **</i>** tags.

→ **SMALL**

The **SMALL** element makes text appear smaller in a browser. The text that must be displayed smaller is enclosed between **<small>** and **</small>** tags.

→ **U**

The **U** element applies an underline to the text. The text that must be underlined is enclosed between **<u>** and **</u>** tags.

Code Snippet 3 demonstrates use of basic formatting elements.

Code Snippet 3:

```
<!DOCTYPE html>

<html>
    <head>
        <title>Formats</title>
    </head>
    <body>
        <h2>Using HTML Formatting Elements</h2><br>
        <b>This text is displayed in bold.</b><br>
        <i>This text is displayed in italic.</i><br>
        <u>This text is underlined.</u><br>
        <small>This text is displayed smaller.</small>
    </body>
</html>
```

Figure 2.2 shows a Website displaying basic text formats.

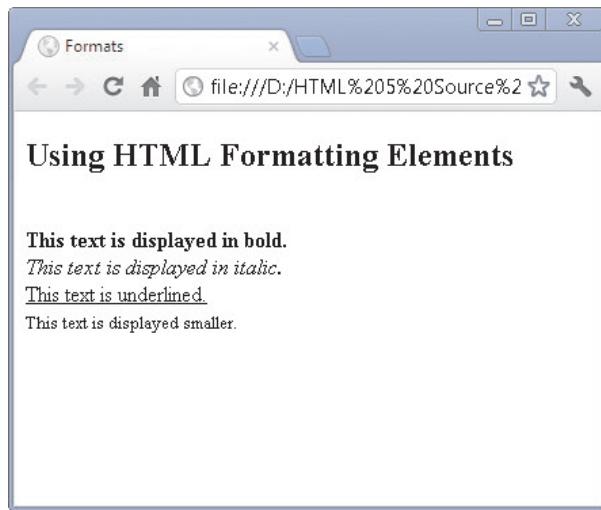


Figure 2.2: Basic Text Formats

You might want to display some text or characters above or below the baseline of its adjacent text. Further, you might want to apply strike through to some text to indicate that it is deleted. Therefore, HTML provides you with some more formatting elements. These formatting elements are as follows:

→ DEL

The `DEL` element encloses text, which has been deleted from the document. The text to be deleted is placed in the `` and `` tags.

→ INS

The `INS` element encloses text, which has been inserted in the document. The text to be inserted is placed in the `<ins>` and `</ins>` tags. The `INS` element can be used with `DEL` element to inform the user about the deleted text, which is replaced by the new text.

→ STRONG

The `STRONG` element emphasizes text as compared to its surrounding text. The text to be emphasized is placed in `` and `` tags.

→ SUB

The `SUB` element displays the text as subscript. The text to be displayed as subscript is enclosed in `_{` and `}` tags.

→ SUP

The `SUP` element displays the text as superscript. The text to be displayed as superscript is enclosed in `^{` and `}` tags.

Code Snippet 4 demonstrates the use of `DEL`, `INS`, `STRONG`, `SUB`, and `SUP` elements.

Code Snippet 4:

```
<!DOCTYPE html>
<html>
    <head>
        <title>Updating and Shifting Text</title>
    </head>
    <body>
        <h3>Updating, Emphasizing, and Shifting Text</h3>
        This is an example of <del>deleted</del> <ins>inserted</ins> text.<br/>
        This is an example of <strong>Strong</strong> text.<br/>
        This is an example of <sub>subscript</sub>text.<br/>
        This is an example of <sup>superscript</sup> text.<br/>
    </body>
</html>
```

Figure 2.3 shows the other text formatting elements.

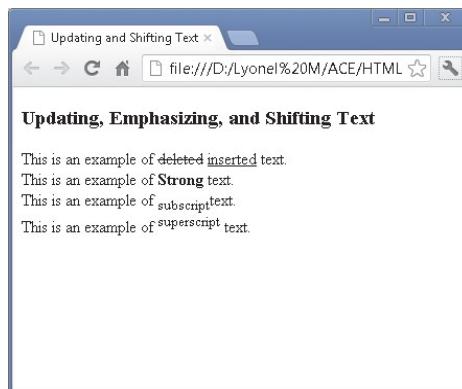


Figure 2.3: Other Text Formatting Elements

2.4 Monospaced and Preformatted Text

By using monospaced font in HTML5, a Web developer can provide the same amount of horizontal space between fonts, even if font size, shape, and type are not the same. Monospaced fonts are used for programming code scripts, instruction texts, and ASCII characters.

The `<pre>` tag is used to apply preformatted text content to a Web page.

The `<pre>` tag applies a fixed-font width to the text content. It also maintains a standard formatting for spaces and line breaks. The `<pre>` tag is usually used to when you want to copy paste content from a source but do not want to change the formatting of the same. The content would be copied while maintaining all the line breaks and spaces.

Table 2.1 lists some of the other predefined tags available for formatting of text in HTML.

Tag	Description
<code></code>	Used for emphasized text
<code><dfn></code>	Used for a definition term
<code><code></code>	Used for a computer code
<code><samp></code>	Used for sample output from a computer program
<code><cite></code>	Used for a citation

Table 2.1: Predefined Tags

2.4.1 Format a Block Quotation

To define a long quotation or block quotation, the `<blockquote>` tag can be used. When the `<blockquote>` tag is used, the quotation is indented in browsers.

Code Snippet 5 shows the use of the `<blockquote>` tag.

Code Snippet 5:

```
<blockquote>
    "When one door closes, another opens; but we often look so long and so
    regretfully upon the closed door that we do not see the one which has
    opened for us." -Alexander Graham Bell
</blockquote>
```

2.5 Lists

A list is a collection of items, which might be organized in a sequential or unsequential manner. You can use a list to display related items that belong to a particular category. For example, to display the types of computers, such as mainframe, microcomputer, and laptops, you would organize these items one below the other under the Types of Computers category. Similarly, HTML allows you to display related items in a list on a Web page.

A list in HTML can contain paragraphs, line breaks, images, links, and other lists. The items within a list are displayed on a Web page one below the other using bullets. HTML supports three types of lists. These are as follows:

- ➔ Ordered
- ➔ Unordered
- ➔ Definition

Figure 2.4 shows different types of lists.



Figure 2.4: Different Types of Lists

2.5.1 Ordered List

An ordered list is a list of items arranged in a particular order. Here, the order of the items is important as it indicates a sequential flow. For example, to display the days in a week or months in a year, you would use numbered bullets. Similarly, HTML allows you to implement ordered lists where each item in the list is displayed using a numbered or alphabetic bullet. HTML provides two elements for creating an ordered list. These are as follows:

- **OL:** Creates an ordered list.
- **LI:** Specifies an item and it is a sub-element of the OL element.

Code Snippet 6 demonstrates the use of **OL** and **LI** tags to display weekdays as an ordered list.

Code Snippet 6:

```
<!DOCTYPE html>
<html>
    <head>
        <title>Days in a Week</title>
    </head>
    <body>
        <h2>Days in a Week:</h2>
        <ol>
            <li>Sunday</li>
            <li>Monday</li>
            <li>Tuesday</li>
            <li>Wednesday</li>
            <li>Thursday</li>
            <li>Friday</li>
            <li>Saturday</li>
        </ol>
    </body>
</html>
```

Figure 2.5 shows an example of an ordered list.

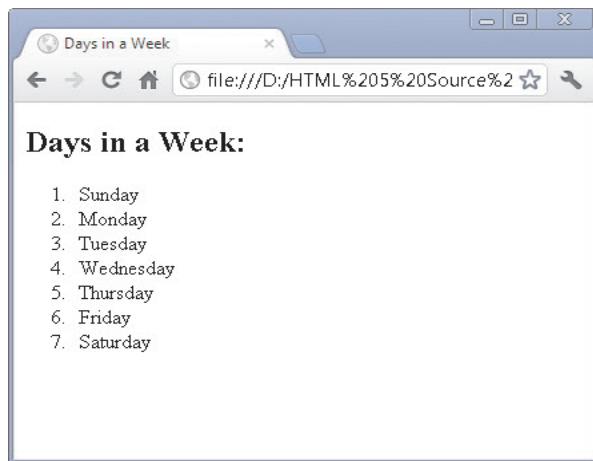


Figure 2.5: Ordered List

Different numbering styles, such as roman numerals or alphabetic bullets, can be applied to an ordered list. Table 2.2 shows different numbering styles that can be specified in an ordered list.

Property's Value	Example
decimal	1, 2, 3, ...
lower-alpha	a, b, c, ...
upper-alpha	A, B, C, ...
lower-roman	i, ii, iii, ...
upper-roman	I, II, III, ...

Table 2.2: Different Numbering Styles

The `list-style-type` property is used to specify a numbering style for the ordered list. It is the property of the `style` attribute, which is specified within the `` tag.

Code Snippet 7 demonstrates the use of `list-style-type` property for adding a numbering style to a numbered list.

Code Snippet 7:

```
<ol style=list-style-type:lower-roman>
  <li>Sunday</li>
  <li>Monday</li>
  <li>Tuesday</li>
  <li>Wednesday</li>
  <li>Thursday</li>
  <li>Friday</li>
  <li>Saturday</li>
</ol>
```

The `list-style-type` property of the `style` attribute in the code is set to `lower-roman`. The property and its value are separated by a colon. This means that the days of the week will be displayed sequentially by applying the lower-cased Roman numbers as bullets. Figure 2.6 shows the `lower-roman` style.

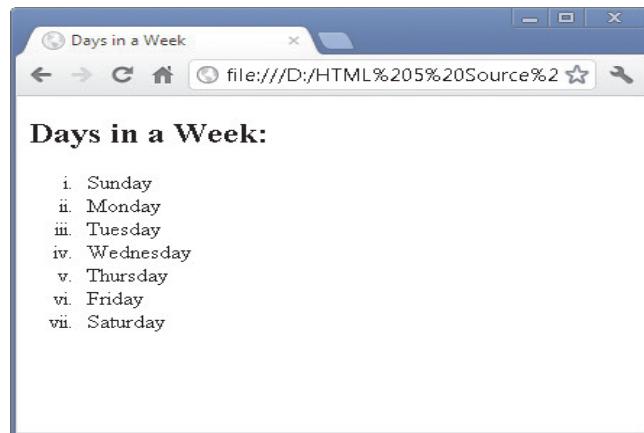


Figure 2.6: lower-roman Style

2.5.2 Unordered List

An unordered list is a list where the items are arranged in a random order. This means that you will create an unordered list when the order of related items is not important. For example, to list the features of a product, you would create an unordered list. Each item in an unordered list is displayed using symbolic bullets such as circles and squares. These bullets are similar to the bullets provided by Microsoft Office Word. HTML provides the `UL` element to create an unordered list.

Code Snippet 8 demonstrates how to display features of a product as an unordered list.

Code Snippet 8:

```
<!DOCTYPE html>
<html>
    <head>
        <title>Features of EasyPad</title>
    </head>
    <body>
        <h2>Features of EasyPad</h2>
        <ul>
            <li>Opens many files at a time</li>
            <li>Unlimited undo and redo</li>
            <li>Reads and writes both Windows and Unix files</li>
        </ul>
    </body>
</html>
```

Figure 2.7 shows an example of an unordered list.



Figure 2.7: Unordered List

The `UL` element contains the `` tag and multiple `li` sub-elements. The `` tag marks the beginning of the unordered list. Each of the `li` sub-elements starts with the `` tag followed by a feature of the EasyPad product. Each feature will be displayed with the default symbolic bullet, which is a small black disc.

The `list-style-type` property specifies the type of bullet to be applied to an unordered list. There are three types of bullets defined for the unordered lists in HTML. These bullet types are namely, `disc`, `square`, and `circle`. The default value is `disc`, which is applied to the unordered list, even if the `list-style-type` property is not specified.

Code Snippet 9 demonstrates how to apply the square bullet to an unordered list.

Code Snippet 9:

```
<!DOCTYPE html>
<html>
  <head>
    <title>Wild Animals</title>
  </head>
  <body>
    <h2>Wild Animals</h2>
    <ul style="list-style-type:square">
      <li>Lion</li>
      <li>Tiger</li>
      <li>Leopard</li>
      <li>Wolf</li>
    </ul>
  </body>
</html>
```

The `list-style-type` property of the `style` attribute is set to `square`. This means that the unordered list of wild animals will be displayed using the square bullet as shown in Figure 2.8.



Figure 2.8: Square Bulleted Unordered List

2.5.3 Definition List

A definition list refers to a collection of terms with their corresponding descriptions. For example, you can display a glossary on a Web page by creating a definition list, which will contain the terms and their descriptions. A definition list appears with the term indented on the left followed by the description on the right or on the next line. By default, the description text appears on the next line and is aligned with respect to the term.

You can specify a single line or multiple lines of description for each term. HTML provides three elements to create a definition list. These elements are as follows:

- ➔ **DL**
Is a container element that consists of the **DT** and **DD** sub-elements. It specifies that a definition list will be created using these elements.
- ➔ **DT**
Specifies the term to be defined or described.
- ➔ **DD**
Specifies the definition or description of the term.

Consider a scenario, where you want to create a Web page that will display types of nouns with their descriptions. To do this, you must create a definition list. Steps to create a definition list are as follows:

1. Specify the **DL** element to indicate that you want to create a definition list.
2. Use the **DT** element to specify the term such as Common Noun.
3. Use the **DD** element to specify the description of the term.

Code Snippet 10 demonstrates the way to create a definition list.

Code Snippet 10:

```
<!DOCTYPE html>
<html>
  <head>
    <title>Types of Nouns</title>
  </head>
  <body>
    <h2>Types of Nouns</h2>
    <dl>
      <dt><b>Common Noun:</b></dt>
      <dd>It is a name of an object in general, such as pencil, pen, paper, and so on.</dd>
      <dt><b>Proper Noun:</b></dt>
      <dd>It is the unique name of a person or a place.
    </dd>
  </dl>
</body>
</html>
```

Figure 2.9 shows an example of a definition list.

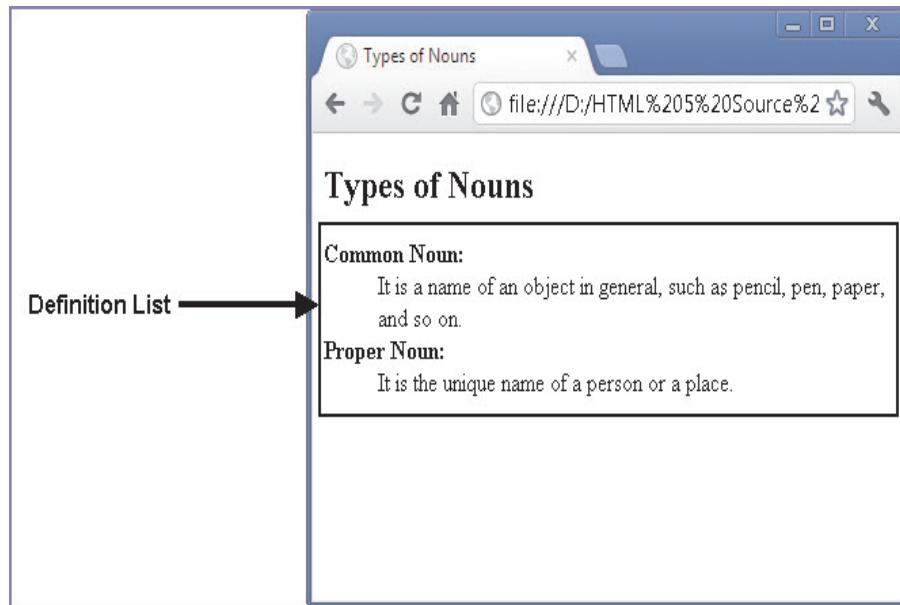


Figure 2.9: Definition List

2.6 Background and Foreground Colors

HTML provides background properties that specify the background color and image for the Web pages. To specify a background for a Web page, use the `background` property. The `background` property is a shorthand property that specifies all the background properties in just one declaration.

The `bgcolor` attribute specifies the background color of a document.

Syntax:

```
<body bgcolor="color_name|hex_number|rgb_number">
```

where,

- color_name - Specifies the background color with a color name (such as "red")
- hex_number - Specifies the background color with a hex code (such as "#ff0000")
- rgb_number - Specifies the background color with an rgb code (such as "rgb(255, 0, 0)")

Code Snippet 11 demonstrates how to specify a background color for an HTML document.

Code Snippet 11:

```
<html>
  <body bgcolor="#E6E6FA">
    <h1>Hello world!</h1>
    <p><a href="http://www.w3schools.com">
      Visit W3Schools.com!</a></p>
  </body>
</html>
```

Another way to specify a background color for a Web page is by using the attribute `style="background-color: color"`. This attribute must be added to the `<body>` tag. An example for applying a background color using `style` attribute is as follows:

Example:

```
<body style="background-color: yellow">
```

The color name 'yellow' can also be replaced by the hex code or the rgb code.

The default text color of the page is specified as the foreground color. The foreground color can be specified by using the `style="color: color"` attribute. An example for applying a background and foreground color using the `style` attribute is as follows:

Example:

```
<body style="background-color: navy; color: yellow">
```

2.7 Background Image File

A Website developer can also insert an image as the background on a Web page. These background images are not recommended as sometimes the colors in the image may hide the text content. Hence, it is best to choose images with lighter shades. Also, as the image is tiled, it is best to choose an image that blends well and looks like a single image even after it is tiled.

Code Snippet 12 demonstrates the way to specify a background image in an HTML Web page.

Code Snippet 12:

```
<html>
  <body background="bgimage.jpg">
  </body>
</html>
```

2.8 Introduction

A Website is a collection of Web pages, which facilitate sharing information on the Internet. There should be some mechanism to allow the user to navigate through the Web pages of a Website. It should also allow the user to view the Web pages of other Websites, if required. These tasks can be achieved by creating hyperlinks in HTML.

2.9 Hyperlinks

A hyperlink is referred to as a link. It refers to linking to another Web page or to a section in the same Web page.

The A (anchor) element is used to create a hyperlink. You can specify a text or an image as a hyperlink. When you move the mouse over such content, the cursor changes into a hand with its index finger pointing towards the content. This means that clicking them will take you to the respective link. To specify the linked page section or linked Web page, you must use the attributes of the A element. Table 2.2 lists the attributes of the A element.

Attribute	Description
href	Specifies the URL of the Web page to be linked or the value of the name attribute.
hreflang	Indicates the language of the destination URL.
name	Specifies the section of the Web page, which is to be linked.

Table 2.2: Attributes of the A Element

Note - The A element cannot contain any other A elements.

The basic syntax to provide a hyperlink is always the same. The `<a>` tag is used to provide a hyperlink. This contains the `href=` attribute that would contain the link to a URL or path of a Web page. An example of a href attribute code is as follows:

```
<a href=" http://www.contoso.com/">
```

The description and reference text that will serve as a hyperlink must be provided before closing the `<a>` tag by using ``. Note that the actual Website `http://www.contoso.com/` does not exist. It is just used here to demonstrate href.

An example of a hyperlink along with its output is as follows:

Example:

```
<html>
  <head>
  </head>
  <body>
    <a href="http://www.contoso.com/">
      Click to view the Contoso Website</a>
    </body>
</html>
```

The output of the example is shown in Figure 2.10.

Note that the actual Website <http://www.contoso.com/> does not exist. It is just used here to demonstrate href.

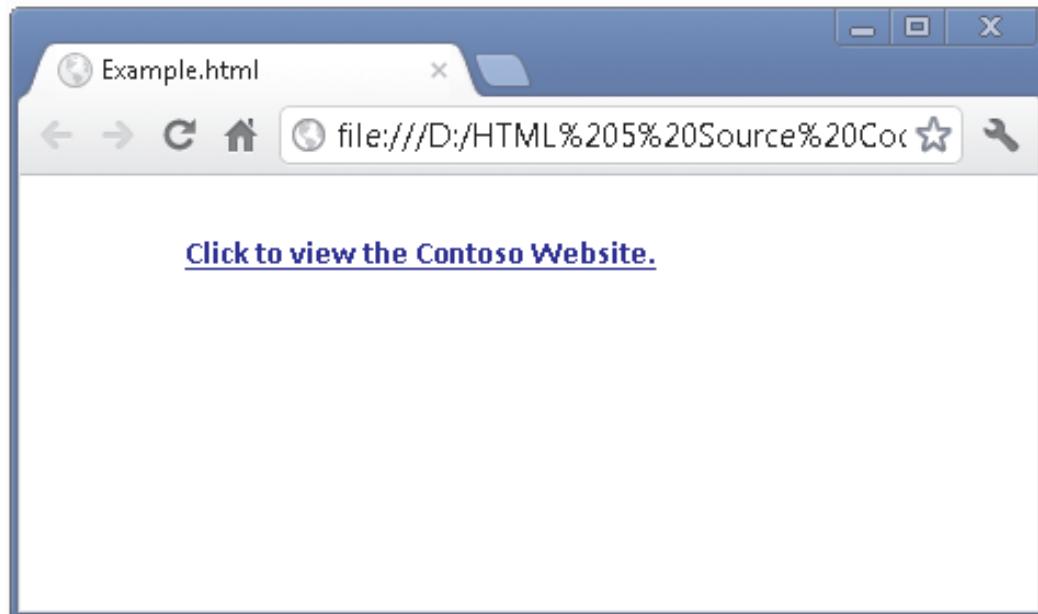


Figure 2.10: Output of a href

2.9.1 Target Attributes

The `target` attribute of the `A` element specifies the location where the linked Web page will open when a link is clicked.

You can assign values to the `target` attribute. Table 2.3 lists some of the values of the `target` attribute.

Value	Description
<code>_blank</code>	Loads the target URL in a new blank window.
<code>_self</code>	Loads the target URL in the same window as that of the current Web page.
<code>_top</code>	Loads the target URL in the complete area of window.

Table 2.3: Values of the `target` Attribute

2.10 Absolute and Relative Paths

Absolute paths are links that contain the complete address to get to a Web page. Absolute paths are the best way to link to a Website. The syntax of an absolute path is as follows:

Syntax:

```
<a href="http://www.contoso.com/pages/about-us/  
aboutus_aboutcontoso.html">Contoso Website</a>
```

Relative paths are links that are provided when the files of a Web page are in the same folder as the page displaying the link. The syntax of a relative path is as follows:

Syntax:

```
<a href="aboutus_aboutcontoso.html">Contoso Website</a>
```

To link to files present in the sub folder, you must provide the path to the sub folder. For example, if the file `aboutus_aboutcontoso.html` is in a sub folder named `about-us` then, the syntax is as follows:

Syntax:

```
<a href="about-us/aboutus_aboutcontoso.html">Contoso Website</a>
```

Files that are present in folders that are one level up can also be linked using a relative path. The syntax to link to a file one level up is as follows:

Syntax:

```
<a href="../aboutus_aboutcontoso.html">Contoso Website  
</a>
```

2.11 Hyperlink to an E-mail Address

Hyperlinks can be even applied to e-mail addresses in the same way as they can be given for Web pages. There are various tasks that can be performed when a hyperlink are given to an e-mail. Some of these tasks include starting the default e-mail client, creating a new message, inserting the recipients address, adding the subject line, and so on.

To add an e-mail to a hyperlink, the `href=` attribute must be used and followed by `mailto:email address`. Code Snippet 13 shows the way to hyperlink an e-mail address.

Code Snippet 13:

```
<a href="mailto:customercare@contoso.com">Customer Care</a>
```

To automatically add a subject line in the new e-mail message, the `?subject=` attribute must be inserted after the e-mail address. Code Snippet 14 shows the way to add a subject line to a hyperlinked e-mail address.

Code Snippet 14:

```
<a href="mailto:customercare@contoso.com?subject=E-mail to Customer Care">Customer Care</a>
```

2.12 Hyperlink to Other Types of Content

Hyperlinks can be used to not only refer to another Web page or e-mail address but also can be used to link to other files and documents. Some of the files that are commonly linked on Web pages using hyperlinks are zipped files (.zip), executable files (.exe), documents (.doc), PDF reader files (.pdf), and so on. Hyperlinks can also be used to link to graphical .jpg and .gif files. To specify a file instead of the Web page, the name of the file must be provided in the `<a>` tag as shown in Code Snippet 15.

Code Snippet 15:

```
<a href="Compressed.zip">Click to download the compressed zip file</a>
```

2.13 Check Your Progress

1. Which of the following formatting element emphasizes the text as compared to its surrounding text?

(A)	B	(C)	I
(B)	Strong	(D)	U

2. Which of the following tag is used to specify a definition term?

(A)		(C)	<dfn>
(B)	<code>	(D)	<blockquote>

3. Which of the following are the two elements used for creating an ordered list?

(A)	OL	(C)	LI
(B)	UL	(D)	DF

4. The _____ tag is used to apply preformatted text content to a Web page.

(A)	<pre>	(C)	<dfn>
(B)		(D)	<a>

5. _____ fonts are used for programming code scripts, instruction texts, and ASCII characters.

(A)	Spaced	(C)	Hyperspaced
(B)	Monospaced	(D)	Preformatted

6. Which of the following attribute is used to provide a hyperlink?

(A)	<a>	(C)	
(B)	<h>	(D)	

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7. Which of the following value loads the target URL in the same window of the current Web page?

(A)	_blank	(C)	_top
(B)	_self	(D)	_bottom

8. Which of the following paths has links that contain the complete address to get to a Web page?

(A)	Absolute	(C)	Relative
(B)	Non-Absolute	(D)	Non-Relative

9. To automatically add a subject line in the new e-mail message, the _____ attribute must be inserted after the e-mail address.

(A)	?subject=	(C)	?subject line=
(B)	?subjectline=	(D)	?topic=

10. The _____ attribute of the A element specifies the location where the linked Web page will open when a link is clicked.

(A)	subject	(C)	target
(B)	object	(D)	pageopen

2.13.1 Answers

1.	B
2.	B
3.	A, C
4.	A
5.	B
6.	A
7.	B
8.	A
9.	A
10.	C

Summary

- The heading elements define headings for contents such as text and images.
- The <hgroup> element is used to group titles and their subtitles.
- Monospaced fonts are used for programming code scripts, instruction texts, and ASCII characters.
- The <pre> tag is used to apply preformatted text content to a Web page.
- To define a long quotation or block quotation, the <blockquote> tag can be used.
- A list is a collection of items, which might be organized in a sequential or nonsequential manner. HTML supports three types of lists namely, ordered, unordered, and definition.
- HTML provides background properties that specify the background color and image for the Web pages.
- A hyperlink is referred to as a link. It refers to linking to another Web page or to a section in the same Web page.
- The A (anchor) element is used to create a hyperlink.
- The target attribute of the A element specifies the location where the linked Web page will open when a link is clicked.
- Absolute paths are links that contain the complete address to get to a Web page.
- Relative paths are links that are provided when the files of a Web page are in the same folder as the page displaying the link.
- To add an e-mail to a hyperlink, the href= attribute must be followed by mail to: email address.
- Hyperlinks can also be used to link to files and documents such as zipped files (.zip), executable files (.exe), documents (.doc), PDF reader files (.pdf), and so on.

Try It Yourself

1. Create a Web page and insert the content provided containing the same formatting style as shown.

Sample Content

A **multi-tier enterprise application** consists of two types of objects: **application logic components** and **persistent data objects**. Application logic components represent actions and define methods that perform common tasks such as calculating the order price, customer credit card billing, and so on. Session beans model the application logic components as they contain the logic to perform the application tasks.

It is easy and simple to manage the business data present in large organizations as objects rather than as relational rows in a database. Business data when treated as objects are easy to handle and manage as they are compact in nature.

Entities are not associated with only EJBs and can be used in **Java 2 Standard Edition (J2SE)** environment. The differences between an Entity and a Session bean are as follows:

- Entities have a client-visibility and a persistent identity that is distinct from their object reference. Each entity is distinct from the other because of their identities. Clients can use identities to pass the reference of an entity to other applications. However, this is not possible with Session beans.
- Entity bean cannot be accessed remotely, whereas Session beans can be accessed locally as well as remotely.
- Entity's lifetime is not dependent on the application's lifetime. Entity bean have a much longer lifetime than a client's session as it depends on how long the data is present in the database.
- Entities represent data in a storage that is permanent as well as fault-tolerant and hence, they are long lasting and can survive application server or database crash. This data can be reconstructed in the memory. Hence, it can be said that entity is an in-memory representation of persistent data that:
 - ◆ Can be loaded from persistent store and its field populated with the stored data
 - ◆ Can be modified in-memory to change the data values
 - ◆ Can be saved and correspondingly database is updated

2. Apply bold formatting for the required words as shown in the sample content.
3. Apply an unordered bullet list to the text as shown in the sample content.
4. **Solution Anywhere** is an open source software development organization headquarters at Chicago, USA. The company wants to make its presence felt worldwide by creating a Website which will highlight the activities performed by the organization. The organization also provides all the software

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that are available as a freeware. You as a Website developer for the organization have been asked to create following four separate Web pages for the organization:

- a. Home
 - b. About Us
 - c. Downloads
 - d. Contact Us
5. Link all four Web pages to each other using hyperlinks on all four pages.
 6. In the Downloads page, provide a .EXE file along with a downloadable PDF or Document help file.
 7. In the Contact Us page, provide an e-mail address that is hyperlinked. This e-mail link must open a new e-mail with the Subject line as 'New E-mail'.



Session - 3

Introduction to CSS3

Welcome to the Session, **Introduction to CSS3**.

This session explains the concept of CSS along with the CSS structure and rules. It also explains the different approaches that can be employed by the user for defining the styles and linking the style sheets.

In this Session, you will learn to:

- ➔ Identify the new functions of CSS3
- ➔ Explain the different types of selectors
- ➔ Explain nested tags
- ➔ Define Classes and IDs for applying styles
- ➔ Explain the process to apply styles to hyperlink

3.1 Introduction

CSS is a style sheet language used for informing the browser how to present a document. It uses markup language for describing the presentation semantics of a document. In other words, an HTML document defines the content of the file whereas the CSS file defines how HTML elements are to be displayed.

3.2 Cascading Style Sheet 3

CSS is a mechanism used for adding style such as fonts, colors, and spacing to Web documents.

Figure 3.1 shows how a Web page can be styled using CSS.

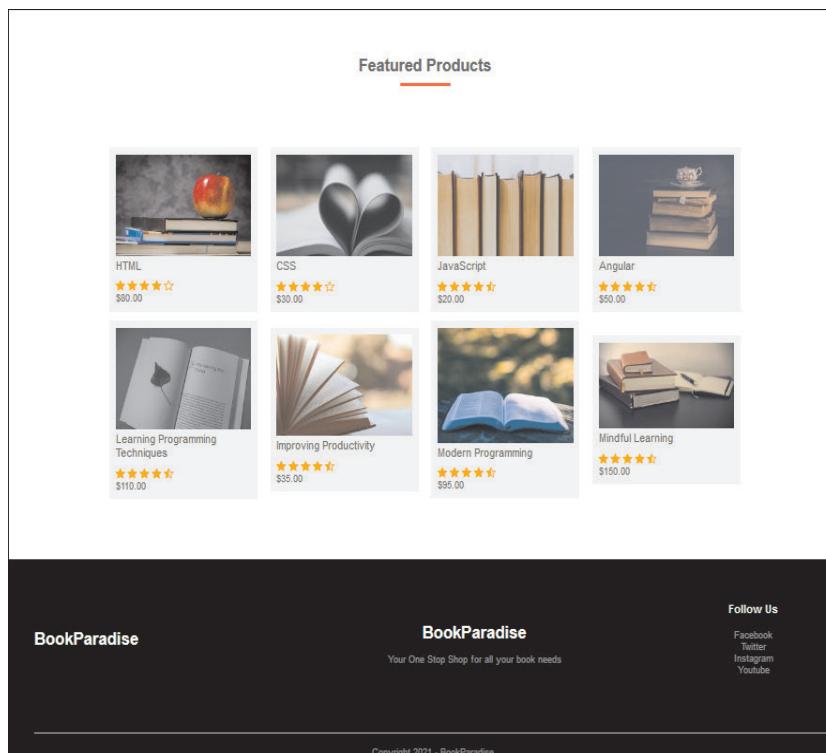


Figure 3.1: CSS3 Logo

CSS has multiple levels and profiles. Each level of CSS is updated from the earlier version, by adding new features. CSS version are denoted as CSS1, CSS2, CSS3, and CSS4, where the numbers are different for each version or level.

Note - The drafting of CSS4 was started by W3C on Sep 29, 2009. However, it is currently not supported by any Web browser.

CSS3 is divided into multiple documents called 'modules'. Each of these modules have new capabilities or extends the features present in CSS2. Drafting of CSS3 started when publication of the original CSS2 recommendation was released. The first CSS3 drafts were released on June 1999. CSS3 extends variety of new ways to create an impact with any designs, with quite a few important changes.

3.2.1 Modules

Since CSS3 is available as modules and is still evolving, there are many modules having different stability and status. Out of the fifty modules published by the CSS working group, only three modules are released as recommendations and they are as follows:

- ➔ CSS Color Level 3
- ➔ CSS Namespaces
- ➔ Selectors Level 3

Following modules are stable and in recommendation stage:

- ➔ Media Queries
- ➔ CSS style Attributes

Following modules are in testing phase and in recommendation stage:

- ➔ CSS Backgrounds and Borders Level 3
- ➔ CSS Image Values and Replaced Content Level 3
- ➔ CSS Marquee
- ➔ CSS Multi-column Layout
- ➔ CSS Speech
- ➔ CSS Mobile Profile 2.0
- ➔ CSS TV Profile 1.0

Following modules are in refining phase and in working draft stage:

- ➔ CSS Transforms
- ➔ CSS Transitions
- ➔ CSS Values and Units Level 3
- ➔ CSS Print Profile

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Following modules are in revising phase and in working draft and recommendation stage:

- ➔ CSS Animations
- ➔ CSS Flexible Box Layout
- ➔ CSS Fonts Level 3
- ➔ CSS Paged Media Level 3
- ➔ CSS Text Level 3
- ➔ CSS Basic User Interface Level 3
- ➔ CSS Writing Modes Level 3
- ➔ CSSOM View

Following modules are in exploring phase and in working draft stage:

- ➔ CSS Cascading and Inheritance Level 3
- ➔ CSS Conditional Rules Level 3
- ➔ CSS Grid Layout
- ➔ CSS Grid Template Layout
- ➔ CSS Line Grid
- ➔ CSS Lists Level 3
- ➔ CSS Tables Level 3
- ➔ Selectors Level 4
- ➔ CSS Object Model

Following modules are in rewriting phase and in working draft stage:

- ➔ CSS Line Layout Level 3

- CSS Ruby
- CSS Syntax Level 3

Following modules are in abandoned phase and in working draft stage:

- Behavioral Extensions to CSS
- CSS Hyperlink Presentation

3.2.2 CSS Syntax

The general syntax of CSS consists of three parts namely, selector, property, and value. A selector is an HTML element for which you want to specify the style or the formatting instruction. A property of a selected element is a CSS property that specifies the type of the style to be applied to the selector. CSS allows controlling the appearance of the content by providing various properties. These properties include text properties, positioning properties, font properties, color properties, and so on. A value refers to value of the CSS property. A CSS property can have multiple values. For example, values of the color property include red, green, yellow, and so on.

The property and the value for a selector are separated with a colon (:). They are enclosed within the curly brackets ({}) that is known as the declaration block. Figure 3.2 shows a CSS syntax.

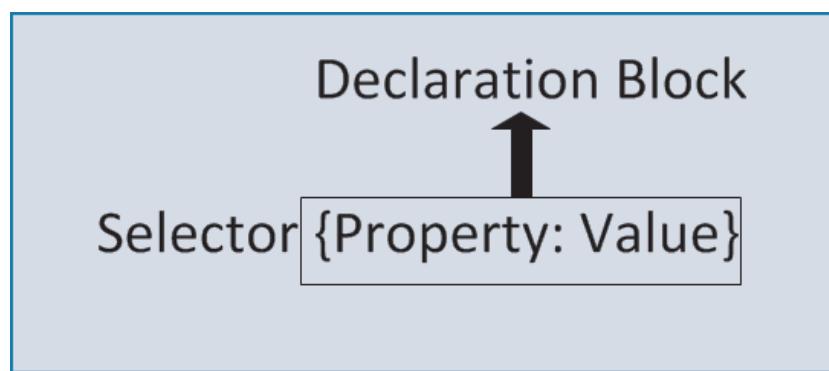


Figure 3.2: CSS Syntax

You can have various combinations to specify rules for HTML elements. First, you can specify multiple property-value pairs for a selector, which are separated by a semicolon (;) within the declaration block. Second, you can specify multiple selectors for a single property by grouping the selectors. To group the selectors, the selectors are separated by commas followed by a declaration block of properties and values. Third, you can specify properties for multiple selectors. Here, the comma-separated selectors are followed with multiple property-value pairs.

Figure 3.3 shows multiple properties and selectors.

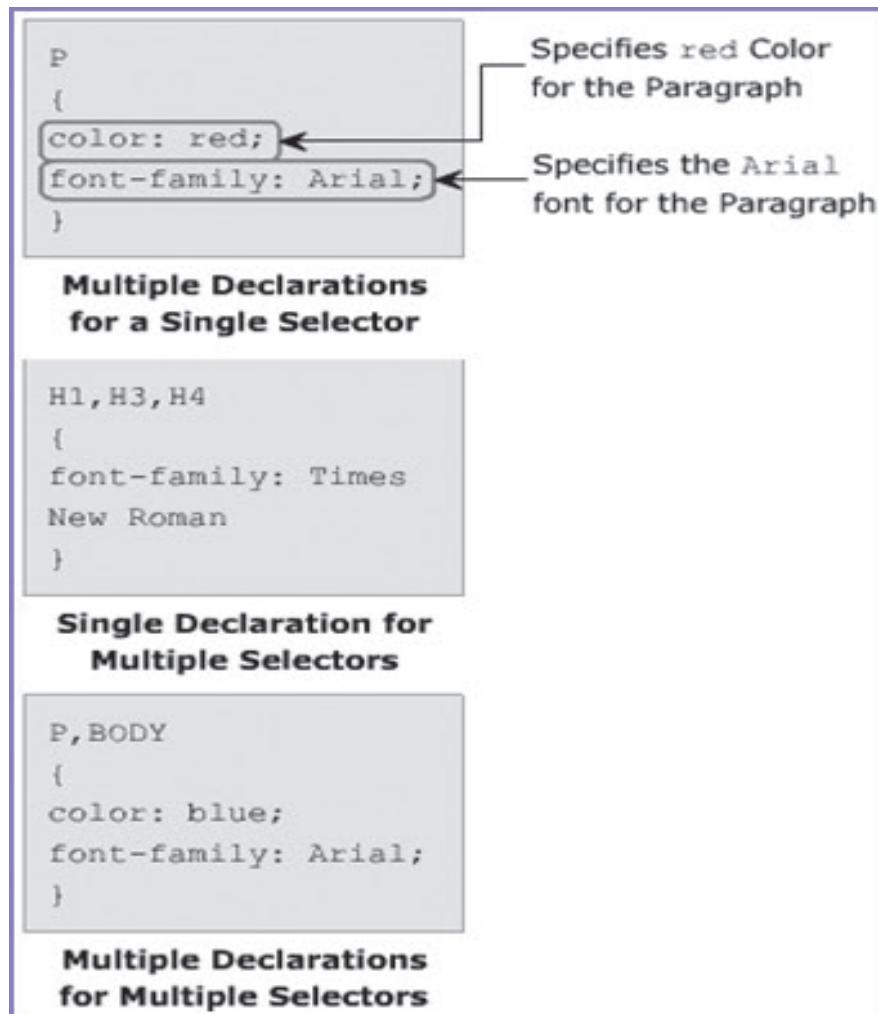


Figure 3.3: Multiple Properties and Selectors

3.2.3 Length Measurement Units

CSS uses various units of measurements for specifying size of the font, width and height of margins, and so on. These units measure the horizontal and vertical length of the content. CSS supports two types of length measurement units namely, relative and absolute.

- **Relative:** Relative length specifies the length units related to other length property that are calculated in comparison to a current value.

Table 3.1 lists the relative length units.

Relative Length	Description
em	Specifies the font size (height) of a particular font. The em unit is relative to the value of the font-size property of the selector.
ex	Specifies the 'x-height' of a particular font. The 'x-height' value is approximately half the font size or the height of the lowercase letter 'x'.
px	Specifies the size in pixels, which is relative to the screen of the device.

Table 3.1: Relative Length Units

Figure 3.4 shows relative lengths.

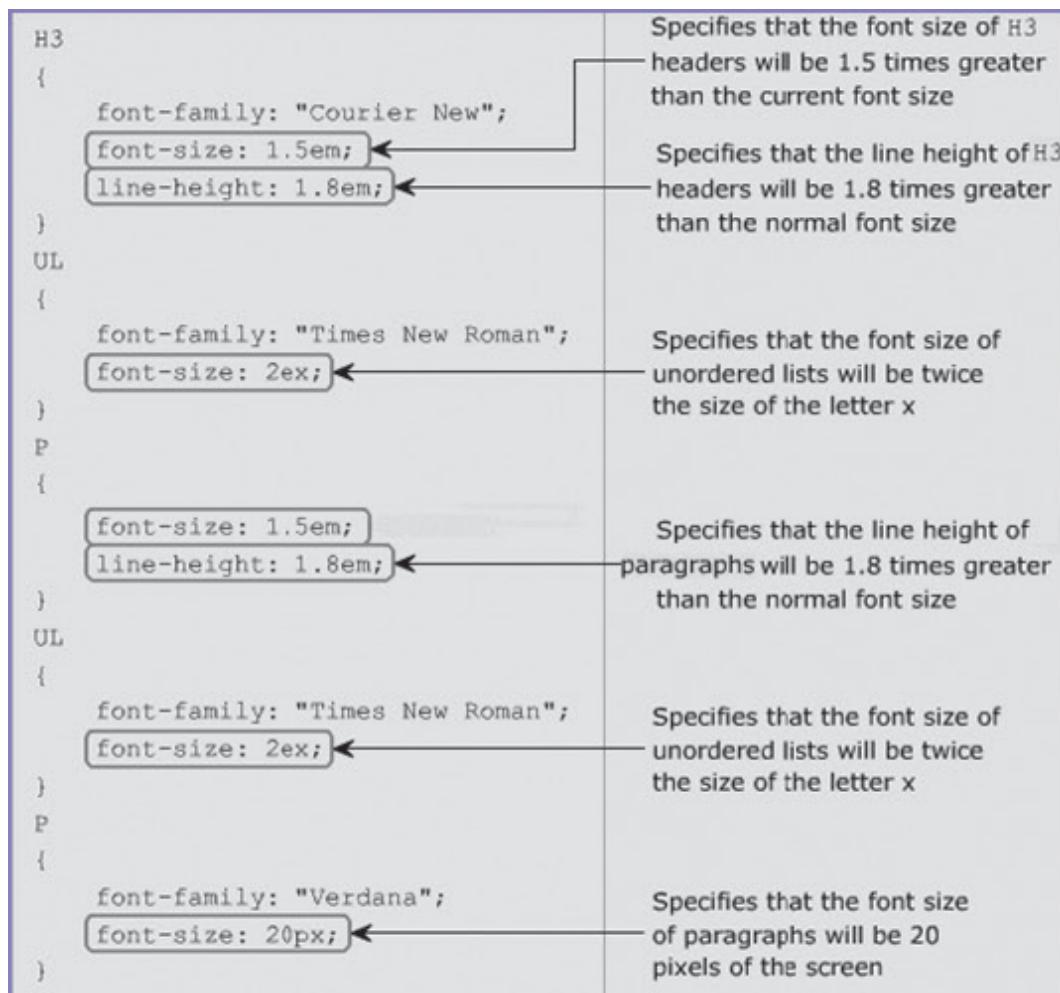


Figure 3.4: Relative Lengths

- **Absolute:** Absolute lengths are specified when the Web page designer is aware of the physical properties of the output device. These are specific and fixed values. Table 3.2 lists the absolute lengths.

Absolute Length	Description
in	Specifies the size in inches, where 1 inch = 2.54 centimeters.
cm	Specifies the size in centimeters.
mm	Specifies the size in millimeters.
pt	Specifies the size in points, where 1 point = 1/72th of an inch.
pc	Specifies the size in picas, where 1 pica = 12 points.

Table 3.2: Absolute Lengths

Figure 3.5 shows absolute lengths.

```
OL
{
    font-family: "Times New Roman";
    font-size: 0.5cm;
}
TD
{
    font-size: 0.2in;
}
CAPTION
{
    font-size: 3mm;
}
```

Figure 3.5: Absolute Lengths

- **Percentages:** Percentage allows specifying the length of the content, which is relative to another value.

Figure 3.6 shows the use of percentage in defining the style.

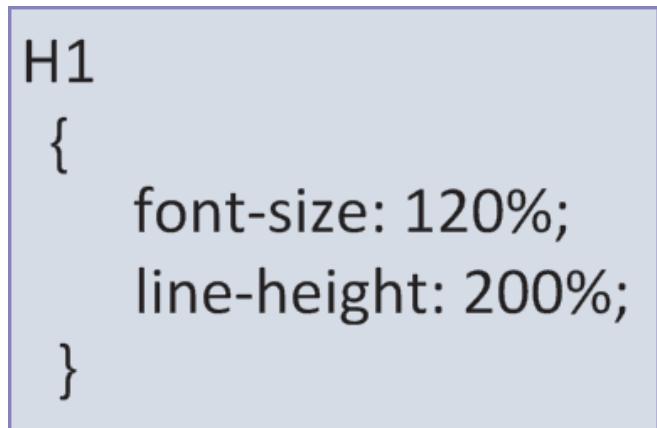


Figure 3.6: Use of Percentage in Defining the Style

In the Figure, the CSS code specifies the styles for the `H1` element. The `font-size` property is set to a value of `120%`. This means that the size of the header will appear `20%` greater than its current size. The `line-height` property is set to the value `200%`. This means that the height of the line will be double the value of the `font-size` property.

3.3 Types of Style Sheets

There are three types of style sheets namely, inline, internal or embedded, and external style sheets. An inline style sheet uses the `style` attribute within an HTML element to specify the style for HTML elements.

An internal style sheet can also be included within the HTML document. However, it is defined using the `style` element within the `style` element. The style rules appear in a declaration block for each HTML element under the `style` element. The `type` attribute of `style` element specifies content `type`, which is `text/css`. This means that content under the `style` element is CSS code. You can specify any combinations of specifying style rules. The style rules specified for an element will be applied to all the sub-elements. Internal style sheets are useful when styles are to be applied to a specific Web page.

3.3.1 Internal/Embedded Styles

Internal styles are placed inside the `<head>` section of a particular Web page source code. These styles can be re-used in the same Web page in which they are placed.

Figure 3.7 shows an internal style.

```
<head>
    <meta charset="utf-8">
    <title>Sample HTML5 Structure</title>
    <style>
        h1, h2 {
            margin: 0px;
            font-size: 1.5em;
        }
        footer {
            background-color: #999;
            text-align: center;
        }
    </style>
</head>
```

Figure 3.7: Internal Style

In Figure 3.7, inside the `<style>` tag, CSS styles for `<h1>`, `<h2>`, and `<footer>` tags are defined. This can be re-used in the same Web page multiple times.

3.3.2 *Inline Styles*

Inline styles are placed directly inside an HTML element. A Web designer cannot use the style builder to create an inline style. Inline style cannot be reused at any point of time in a Web page.

Code Snippet 1 demonstrates the use of an inline style for `<p>` tag.

Code Snippet 1:

```
<p style="font-size: 14px; color: purple;"></p>
```

3.3.3 *External Style Sheet*

An external CSS is defined in a separate file and is saved with the `.css` extension. It provides the benefit of reusability by implementing common style rules for multiple HTML pages. Hence, external CSS are widely used to provide a consistent look across the Web pages of a Website.

Figure 3.8 shows an example of external CSS code.

```
BODY
{
    background-color: gray;
    font-family: arial;
    font-style: italic;
}
```

Figure 3.8: External CSS Code

Explanation for the code shown in Figure 3.8 is as follows:

`background-color: gray;`

Specifies the background color of the Web page as gray.

`Font-family: arial;`

Specifies the font of the textual content as Arial.

`Font-style: italic;`

Specifies the font style of the textual content as italic.

Figure 3.9 shows an example of HTML code using an external CSS style sheet.

```
<!DOCTYPE HTML>
<HTML>
<HEAD>
<LINK rel="stylesheet" type="text/css" href="body.css"/>
<TITLE>Webex e-Server</TITLE>
</HEAD>
<BODY>
This is the fastest web server...!!
</BODY>
</HTML>
```

Figure 3.9: HTML Code using an External CSS Style Sheet

Explanation for the code shown in Figure 3.9 is as follows:

`<LINK`

Specifies that the HTML page is linked to another object.

`rel="stylesheet"`

Specifies that the linked object is a style sheet.

`type="text/css" href="body.css" />`

Refers to an external style sheet of the content type, `text/css`.

Note - An inline style sheet holds the highest priority, which means that the style specified for the same element in any other style sheet will be ignored. The browser-specific styles are applied to a Web page when there are no styles specified for a Web page.

3.4 Selectors

Selectors refer to HTML elements with styles that users want to apply to them. Three different types of CSS selectors are as follows:

- Type selector
- Class selector
- ID selector
- Universal selector

3.4.1 Type Selector

A type selector simply specifies the element name along with the styles to be applied to that element. This results in applying the specified styles to all the occurrence of that element in a Web page. Here, the styles are specified only once for an HTML element and are applied to all the occurrences of that element. Figure 3.10 shows an example of type selector.

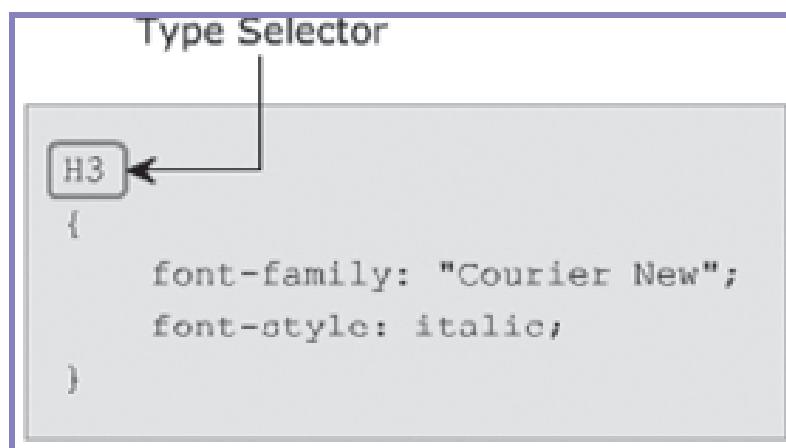


Figure 3.10: Type Selector

3.4.2 Class Selector

A class selector matches elements, whose `class` attribute is set in an HTML page and applies styles to the content of all those elements. For example, if there are `span` and `div` elements in a Web page with their `class` attributes set, the style specified for the class selector will be applied to both the elements. A class selector starts with a period followed by the value of the `class` attribute. Figure 3.11 shows an example of class selector.

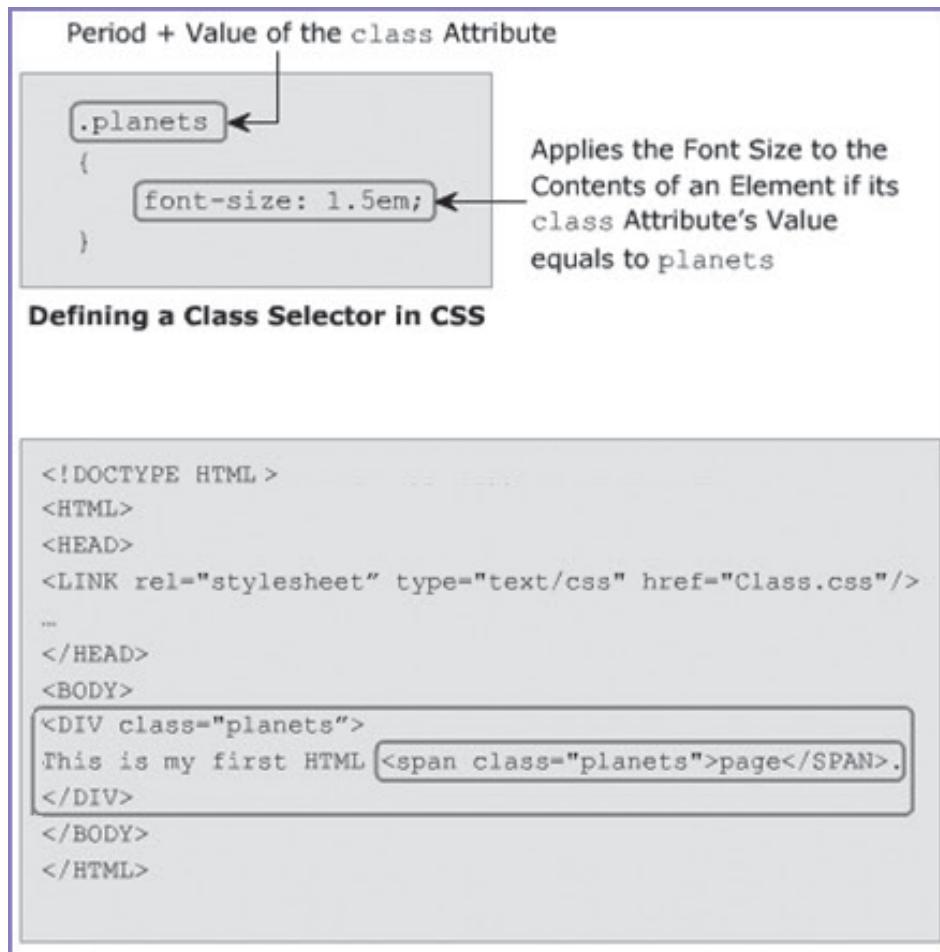


Figure 3.11: Class Selector

In Figure 3.11, the style will be applied to both the places where the values of the `class` attribute have been set to **planets**. If the style is required to be applied to only the `<div>` element then, `class` element would be used as shown in Code Snippet 2.

Code Snippet 2:

```
div.planets
{
    font-size: 1.5em;
}
```

3.4.3 ID Selector

An ID selector matches an element whose id attribute is set in an HTML page and applies styles to the content of that element. The ID selector specifies styles for an element whose id attribute is set to a unique value.

An ID selector starts with the hash symbol (#) followed by the id attribute's value and the declaration block. Figure 3.12 shows an example of ID selector.

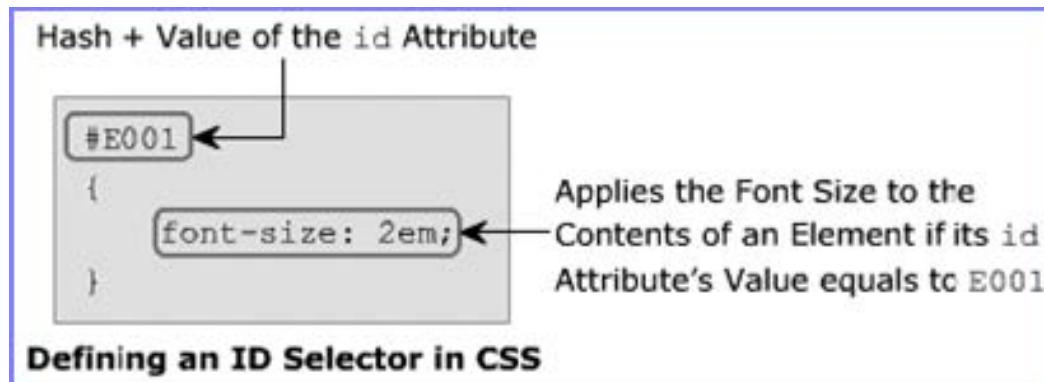


Figure 3.12: Example of ID Selector

3.4.4 Universal Selector

The universal selector can be applied to all elements in the document. This means that it applies the specified styles to the content of all the elements. It is represented by an asterisk (*) sign. For example, universal selector is used define the font family for all the elements as shown in Code Snippet 3.

Code Snippet 3:

```
* {  
    font-family: Verdana, Calibri, sans-serif;  
}
```

3.4.5 Generic Cascading Order

Consider a scenario where you have multiple style sheets defined for an HTML page. These style sheets might have various selectors and multiple styles defined for an HTML element. Therefore, W3C has defined some rules for applying styles to an HTML element. These rules are as follows:

- Gather all the styles that are to be applied to an element.
- Sort the declarations by the source and type of style sheet. The source specifies the origin from where the styles are rendered.

The highest priority is given to the external style sheet defined by an author. The next priority is of the reader, which can be a software that reads the content (screen reader software), and the last priority is of the browser.

- ➔ Sort the declarations by the priority of a selector, where the ID selector has the highest priority.
- ➔ Sort the declaration according to the specified order.

Figure 3.13 shows the generic cascading order.

Lowest Priority	Highest Priority		
Highest Priority ↓	Source	Browser	Reader
	CSS Type	External	Internal
	Selector	Type	Class
			ID

Figure 3.13: Generic Cascading Order

3.4.6 Comments

A comment refers to the descriptive text that allows a Web page designer to provide information about the CSS code. Comments make the program more readable and help the designer to explain the styles specified for elements. This is helpful when other Web designers analyze the CSS code.

The browser can identify comments as they are marked with special characters, which are ‘/*’ and ‘*/’. When the browser encounters these symbols, the text within them are ignored and are not displayed in the browser. You can have single-line and multi-line comments in the CSS file.

Figure 3.14 shows an example using comments in a CSS code.

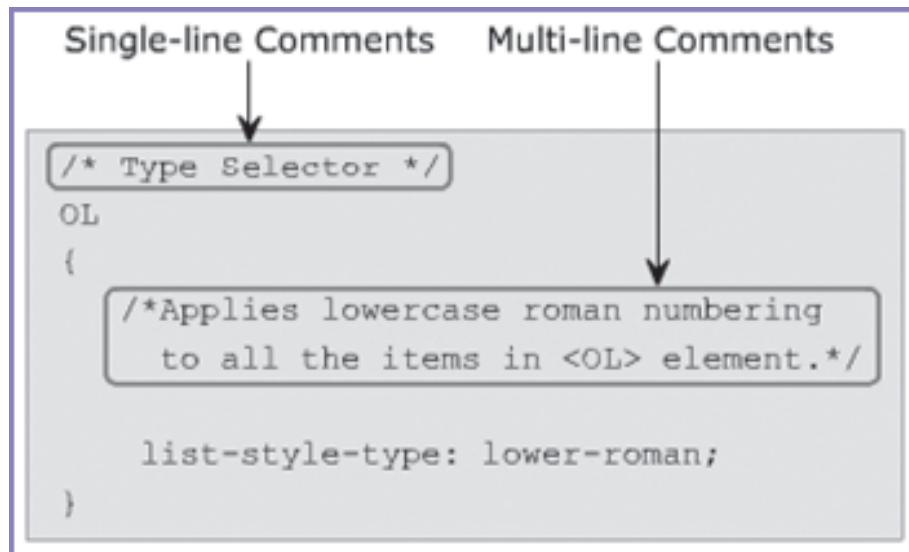


Figure 3.14: Comments in a CSS Code

3.5 Grouping and Nesting of Selectors

In style sheets, there are often elements with the same style.

Code Snippet 4 demonstrates elements with same style.

Code Snippet 4:

```
h1
{
    color:green;
}

h2
{
    color:green;
}

p
{
    color:green;
}
```

To reduce the code, developers can group selectors. Separate each selector with a comma. Code Snippet 5 displays the grouping of selectors.

Code Snippet 5:

```
h1,h2,p
{
    color:green;
}
```

It is also possible to apply a style for a selector within a selector. Code Snippet 6 demonstrates the nesting of selectors.

Code Snippet 6:

```
p
{
    color:green;
}
.changed
{
    background-color:red
}
```

In the code, a style is specified for all the paragraphs and another style is specified for all elements whose class attribute has the value set to changed.

3.5.1 Pseudo Classes

Consider a scenario where a Website consists of multiple Web pages linked through hyperlinks. Browse through various Web pages by randomly clicking the links within the main page. At times, it might happen that unknowingly the same Web page get open that you have already visited. In such a case, you might feel the necessity for a mechanism that could differentiate the already visited links from the remaining ones. In CSS, this is possible by using pseudo classes.

Pseudo classes allow the users to apply different styles to the elements such as buttons, hyperlinks, and so on.

Table 3.3 lists different states of an element.

State	Description
active	Defines a different style to an element that is activated by the user.
hover	Defines a different style to an element when the mouse pointer is moved over it.
link	Defines a different style to an unvisited hyperlink.
visited	Defines a different style to the visited hyperlink.

Table 3.3: Different States of an Element

The syntax demonstrates how to declare a pseudo class.

Syntax:

`selector_name:state_name {property: value}`

where,

`selector_name`: Is an element name.

`state_name`: Is one of the states of an element.

`property`: Is any CSS property such as color, border, and font.

Table 3.4 lists selector name and its descriptions.

Selector Name	Description
<code>:link</code>	Is used for selecting all unvisited links
<code>:visited</code>	Is used for selecting all visited links
<code>:active</code>	Is used for selecting the active link
<code>:hover</code>	Is used for selecting links on mouse over
<code>:focus</code>	Is used for selecting the input element which has focus
<code>:first-letter</code>	Is used for selecting the first letter of each <code><p></code> element
<code>:first-line</code>	Is used for selecting the first line of each <code><p></code> element
<code>:first-child</code>	Is used for selecting each <code><p></code> elements that is the first child of its parent
<code>:before</code>	Is used for inserting content before each <code><p></code> element
<code>:after</code>	Is used for inserting content after each <code><p></code> element
<code>:lang (language)</code>	Is used for selecting each <code><p></code> element with a lang attribute value

Table 3.4: Selector Name and its Descriptions

Pseudo classes specify the styles to be applied on an element depending on its state. In CSS3, a selector can contain multiple pseudo-classes. These pseudo-classes should not be mutually exclusive. For example, the selectors `a:visited:hover` and `a:link:hover` are applicable, but `a:link:visited` is not applicable because `:link` and `:visited` are mutually exclusive selectors. The HTML code creates a form that accepts the customer details and provides a link that allows the user to view the bill as shown in Figure 3.15.

```
<!DOCTYPE HTML>
<HTML>
<HEAD>
<TITLE>Bill Payment Form</TITLE>
<LINK rel="stylesheet" type="text/css" href="Payment.css" />
</HEAD>
<BODY>
<H2>Payment Details</H2>
<FORM method="POST" action="">
<TABLE>
<TR>
<TD>Name:</TD>
<TD><INPUT type="text" /></TD>
</TR>
<TR>
<TD>Payment Mode:</TD>
<TD>
<SELECT>
<OPTION>Select...</OPTION>
<OPTION>Credit Card</OPTION>
<OPTION>Cash</OPTION>
</SELECT>
</TD>
</TR>
<TR>
<TD>Total Amount:</TD>
<TD><INPUT type="text" /></TD>
</TR>
</TABLE>
</FORM>
<A href="printform.html">click here to view the bill.</A>
</BODY>
</HTML>
```

Figure 3.15: HTML Code

CSS code specifies different styles for the visited links, unvisited links, and for the links when the mouse hovers over it.

Figure 3.16 shows a style sheet code.

```
a:link
{
    color: white;
    background-color: black;
    border: 2px solid white;
}

a:visited
{
    color: white;
    background-color: brown;
    border: 2px solid white;
}

a:hover
{
    color: black;
    background-color: white;
    border: 2px solid black;
}
```

Figure 3.16: Style Sheet Code

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Explanation for the code shown in Figure 3.16 is as follows:

```
a:link  
{  
    color: white;  
    background-color: black;  
    border: 2px solid white;  
}
```

Specifies the styles for an unvisited link.

```
a:visited  
{  
    color: white;  
    background-color: brown;  
    border: 2px solid white;  
}
```

Specifies the styles for a visited link.

```
a:hover  
{  
    color: black;  
    background-color: white;  
    border: 2px solid black;  
}
```

Specifies the styles for a link when a mouse hovers over it.

Figure 3.17 shows an example output of mouse hovered link.

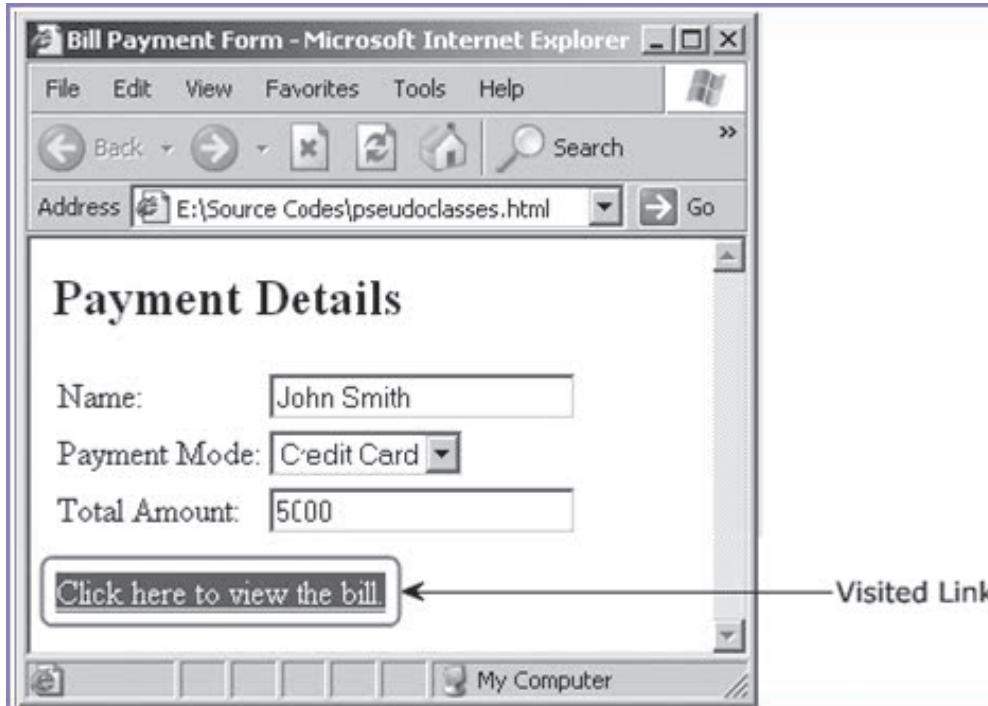


Figure 3.17: Output of Mouse Hovered Link

3.5.2 Purpose of Pseudo Elements

Consider a scenario where you are designing a Website that explains the important technical terms. While defining such terms, you might feel the necessity to emphasize more on the first letter by applying different styles. It becomes difficult if you try to apply styles only on the first letter of a line or paragraph. This can be achieved by using the pseudo elements.

Pseudo elements provide you with a flexibility to apply styles to a specific part of the content such as a first letter or first line. This allows you to control the appearance of that specific content without affecting the rest of the content.

Figure 3.18 shows the purpose of pseudo elements.

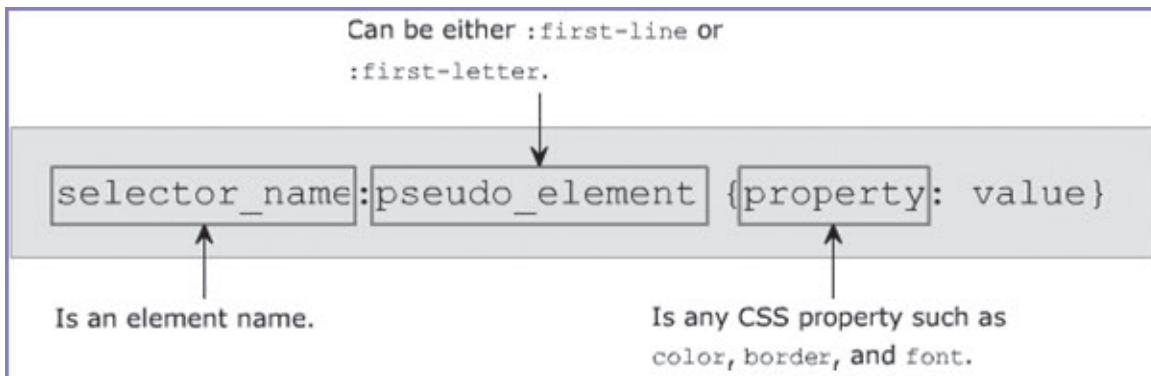


Figure 3.18: Purpose of Pseudo Elements

Pseudo element adds some special effects to HTML elements such as `<p>`, `<body>`, and so on.

Pseudo Elements

The `:first-line` and `:first-letter` pseudo elements allow you to apply styles to the first line and first letter respectively.

→ `:first-line`

The `:first-line` pseudo element allows you to apply styles to the first line.

Figure 3.19 shows an HTML code where the `:first-line` pseudo element will be used.

```
<!DOCTYPE HTML>
<HTML>
<HEAD>
<TITLE>E-Commerce</TITLE>
<LINK rel="stylesheet" type="text/css" href="E-commerce.css" />
</HEAD>
<BODY>
<H2>E-Commerce</H2>
<P>E-commerce (Electronic commerce) is defined as the sale and purchase of products over the Internet. E-mail, accounting, shipment information, and enterprise information reporting are the some common applications of e-commerce.</P>
</BODY>
</HTML>
```

Figure 3.19: The `first-line` Pseudo Element

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Code Snippet 9 in the style sheet declares the style that will be applied to the first line in the paragraph.

Code Snippet 9:

```
p:first-line
{
font-family: "Tahoma";
font-weight: bolder;
background-color: #FFFFCC;
}
```

Specifies the styles to be applied to the first line of the paragraph content.

→ **:first-letter**

The `:first-letter` pseudo element allows you to apply styles to the first letter.

Figure 3.20 shows an example of the HTML code for the `:first-letter` pseudo element.

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="utf-8">
    <title>Physical Chemistry</title>
    <link rel="stylesheet" type="text/css" href="Cefine.css"></link>
  </head>
  <body>
    <h2>Physical Chemistry</h2>
    <p>Physical chemistry is a branch of chemistry that analyzes the physical chemicals.</p>
```

Figure 3.20: The `:first-letter` Pseudo Element

Figure 3.21 shows CSS code for the `:first-letter` pseudo element.

```
p:first-letter
{
  font-family:fantasy;
  font-size:xx-large;
  font-weight:bold;
}
```

Figure 3.21: CSS Code for the `:first-letter` Pseudo Element

Explanation for the code shown in Figure 3.21 is as follows:

`p:first-letter`

Specifies the styles to be applied on the first letter of the paragraph content.

Figure 3.22 shows the output of :first-letter pseudo element.

Physical Chemistry

Physical chemistry is a branch of chemistry that analyzes the physical properties of chemicals.

Figure 3.22: Output of :first-letter Pseudo Element

3.6 Styles to Hyperlink

CSS can be used to change the appearance and behavior of hyperlinks. To do this, use following selectors/pseudo-classes:

- ➔ a
- ➔ a:link
- ➔ a:visited
- ➔ a:hover
- ➔ a:active

This selectors/pseudo classes represent the ‘anchor’ element (specified using the HTML ‘a’ tag) and its various states.

There are two other ways to assign hyperlink styles. They are as follows:

1. Div specific
2. Link specific

3.6.1 ID Specific Hyperlink Styles

A hyperlink styles can be created and assigned to a specific div . This will have all the hyperlinks present within the div to follow the specified rules. It is irrelevant if the div is an (#) id or (.) class.

Code Snippet 10 displays the style for a div id named navone.

Code Snippet 10:

```
#navone a:link {  
    text-decoration: underline;  
    color: #005;  
    background: transparent;  
}  
  
#navone a:visited {  
text-decoration: none;  
    color: #FFA500;  
    background: transparent;  
}  
  
#navone a:hover {  
    text-decoration: none;  
    color: #FFA500;  
    background: transparent;  
}  
  
#navone a:focus {  
    text-decoration: none;  
    color: #FFA500;  
    background: transparent;  
}  
  
#navone a:active {  
    text-decoration: none;  
    color: #FFA500;  
    background: transparent;  
}
```

3.6.2 Class Specific Hyperlink Styles

Specific styling can be assigned to a specific type of hyperlink. This is achieved by creating the style rules in the CSS. For this type of hyperlink styling, a class is used generally than an id. A point to note that an id can only be used once on a page whereas a class can be used multiple times as required.

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Code Snippet 11 displays the use of CSS and HTML file containing a hyperlink with the value of class set to navone.

Code Snippet 11:

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="utf-8">
<style>
.navone:link {
    text-decoration: underline;
    color: #FFF;
    background: #008;
    font-size:30px;
}
.navone:visited {
    text-decoration: none;
    color: #FFF;
    background: #06a;
}
.navone:hover {
    text-decoration: none;
    color: #FFF;
    background: #000;
}
.navone:focus {
    text-decoration: none;
    color: #FFF;
    background: #06b;
}
.navone:active {
    text-decoration: underline;
    color: #FFF;
```

```
background: #06F;  
}  
</style>  
</head>  
<body>  
<a href="6.html" class="navone">LinkText</a>  
</body>  
</html>
```

This link will use the style rule class of navone even if it is placed inside a div that has div specific hyperlink style rules.

Figure 3.23 shows output of a class specific hyperlink.

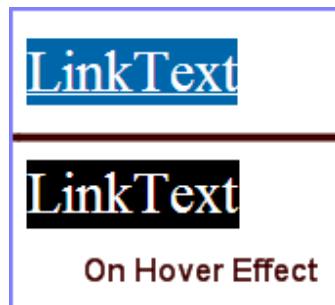


Figure 3.23: Output of a Class Specific Hyperlink

3.7 Check Your Progress

1. Which of the following statements are true for class selector?

(A)	It starts with a period followed by the value of the class attribute
(B)	It matches elements and applies the style to the content of those elements whose class attribute is same
(C)	It specifies the element name along with the style
(D)	It starts with a hash symbol followed by the value of the class attribute

2. Absolute lengths are specified when the Web page designer is aware of the _____ of the output device.

(A)	Text properties	(C)	Image properties
(B)	Physical properties	(D)	Positioning properties

3. Which of these options represent valid style sheets?

(A)	Vertical	(C)	Horizontal
(B)	Inline	(D)	Embedded

4. Which of these options are valid selectors?

(A)	ID	(C)	External
(B)	Inline	(D)	Class

5. Which of the following statements are valid for CSS?

(A)	Can specify multiple property-value pairs for a selector
(B)	Can specify multiple property-value pairs for selector separated by a comma
(C)	Can specify multiple selectors for a single property by grouping the selector
(D)	Can specify only a single selector for a single property

3.7.1 Answers

1.	A, B
2.	B
3.	B, D
4.	A
5.	A, C

Summary

- CSS is a mechanism for adding style such as fonts, colors, and spacing to Web documents. CSS has multiple levels and profiles.
- The general syntax of CSS consists of three parts namely, selector, property, and value.
- Selectors refer to the HTML elements with the styles that are applied to them and they can be Type, Class, ID, or Universal selectors.
- A comment refers to the descriptive text that allows a Web page designer to provide information about the CSS code.
- Pseudo classes allow the users to apply different styles to the elements such as buttons, hyperlinks, and so on.
- Pseudo elements allow the developer to apply styles to a specific part of a content such as first letter or first line.
- A hyperlink style can be assigned either through DIV or through link class.

Try It Yourself

1. Joan O'Brien works for a famous jewelry design company headquartered at Seattle, USA. The management of the company wants to increase the sale of the jewelry produced by reaching out to maximum number of clients spread across the globe. This could be achieved by creating a user friendly and attractive Website for the company. Joan has been asked to develop the Website and make the site attractive by applying different styles to the contents displayed at the Website.



Session - 4

Formatting Using Style Sheets

Welcome to the Session, **Formatting Using Style Sheets**.

CSS is accepted as the standard for defining the presentation of content in HTML pages. This session explains about text formatting and styling of text through CSS. This session also explains paragraph indenting and applying border style using CSS. Finally, this session explains horizontal alignment and vertical spacing in a paragraph and other different layout and formatting features.

In this Session, you will learn to:

- ➔ List and explain text and font styles
- ➔ Describe inline spans
- ➔ Explain paragraph indentation and application of border
- ➔ Explain horizontal paragraph alignment
- ➔ Explain vertical spacing within a paragraph
- ➔ Describe selector specificity and pseudo selectors
- ➔ Explain box model
- ➔ Illustrate the use of positioning and float property

4.1 Introduction

Earlier Web designers had limitations in the presentation of text. `` tags were used to change the color and typeface of the text. Sizing was still a concern and designers used pre-defined font sizes. Effects such as boldness and strike-through were possible only through basic forms of HTML tags. Even, applying different colors to borders and alignment of a paragraph was a concern. Since, Web page presentation has become an important aspect of Web designing, the style sheets allow various styles for formatting texts, borders, or paragraphs.

4.2 Text and Font Style

The text properties specify and control the appearance of the text in a Web page. You can change the color of a text, increase or decrease the space between characters, align a text, and so on using the text properties. Table 4.1 lists different text properties.

Property	Description
<code>color</code>	It is used for specifying the color of the text.
<code>text-align</code>	It is used in specifying the horizontal alignment of text in an element.
<code>text-decoration</code>	It is used for specifying the decoration of the text in an element.
<code>text-indent</code>	It is used for specifying the indentation of first line of text in an element in length or %.
<code>text-transform</code>	It is used in specifying the casing of text in an element.
<code>word-spacing</code>	It is used for increasing or decreasing the space between words.

Table 4.1: Different text Properties

The font properties allow you to specify the font for the text. They allow you to change different font attributes of the text such as font, size, and style of the text. The browser must support the font specified by the font properties. Otherwise, it will display the default font, which is dependent on the browser. Table 4.2 lists different font properties.

Property	Description
<code>font-family</code>	It is used for specifying the font and can specify a generic family or a specific family name such as 'Serif' or 'Times New Roman'.
<code>font-size</code>	It is used for specifying the size of the font and can have an absolute or relative value.
<code>font-style</code>	It is used for specifying the style of the font.
<code>font-variant</code>	It is used for specifying whether the text should be displayed in small-caps.

Table 4.2: Different font Properties

4.2.1 Text Styles

Different text styles such as `text-align`, `text-indent`, and `text-transform` provide different values that allow specifying the alignment, indentation, and casing of text in an element.

The `text-align` property allows the text to be centered, or left or right aligned, or justified. Table 4.3 lists the values of `text-align` property.

Property	Description
<code>left</code>	It is used for aligning the text to the left of the Web page.
<code>right</code>	It is used for aligning the text to the right of the Web page.
<code>center</code>	It is used for aligning the text in the middle of the Web page.
<code>justify</code>	It is used for justifying the text on both sides of the Web page.

Table 4.3: Values of `text-align` Property

As discussed, the `text-indent` property is used for specifying the indentation of the text. Table 4.4 lists the values of `text-indent` property.

Value	Description
<code>length</code>	It is used in specifying fixed indentation and the default value is 0.
<code>%</code>	It is used in specifying an indentation as a percentage of the width of the parent element. The parent element is the element within which the selector element is defined.

Table 4.4: Values of `text-indent` Property

The `text-transform` property is for changing the case of letters in a text. Table 4.5 lists the values of `text-transform` property.

Value	Description
<code>none</code>	It is used in specifying that the text will be displayed with the same casing as written within the element.
<code>capitalize</code>	It is used in specifying that the first letter of each word will be capitalized.
<code>uppercase</code>	It is used in specifying only uppercase letters.
<code>lowercase</code>	It is used in specifying only lowercase letters.

Table 4.5: Values of `text-transform` Property

Code Snippet 1 shows HTML code demonstrating DIV element.

Code Snippet 1:

```
<!DOCTYPE HTML>
<html>
<head>
<link rel="stylesheet" type="text/css" href="TextProperties.css" />
```

```
<title>Client</title>
</head>
<body>
<h2>Client Contact Information</h2>
<div>
<h4>Dynamic Solutions</h4>
<p>Tel Number - 445 558 7744</p>
<p>Fax Number - 703 740 6539</p>
</div>
</body>
</html>
```

CSS Code

Code Snippet 2 displays CSS code that specifies the text styles for the DIV element. The `text-align` property is set to `left`, which will align the text towards the left. The `text-indent` property is set to `2em`, which will indent the text with respect to the font size. The `text-transform` property is set to `uppercase`, which will display all the letters in uppercase.

Code Snippet 2:

```
div
{
text-align: left;
text-indent: 2em;
text-transform: uppercase;
}
```

The text specified in the DIV element is aligned towards the left and all the letters are displayed in uppercase.

Figure 4.1 shows output.



Figure 4.1: Output

The `text-decoration` and `word-spacing` properties provides different values that allow the user to specify the decoration and word spacing of text in an element.

Table 4.6 lists the values assigned to the `text-decoration` property.

Value	Description
none	It is used for displaying normal text without any formatting.
underline	It is used for displaying a line under the text.
overline	It is used for displaying a line over the text.
line-through	It is used for displaying a line through the text.
blink	It is used for flashing the text.

Table 4.6: Values Assigned to the `text-decoration` Property

Table 4.7 lists the values assigned to the `word-spacing` property.

Value	Description
normal	It is used in specifying normal spacing between words and it is the default value.
length	It is used in specifying fixed space between words.

Table 4.7: Values Assigned to the `word-spacing` Property

Code Snippet 3 shows the HTML code demonstrating header and paragraph.

Code Snippet 3:

```
<!DOCTYPE HTML>
<html>
<head>
<link rel="stylesheet" type="text/css" href="ParaProperties.css" />
<title>Solar System</title>
</head>
<body>
<h3>Nine Planets</h3>
<div>
<p>Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto</p>
</body>
</html>
```

Code Snippet 4 displays CSS code that specifies text properties for the `body` and `h3` elements. The `word-spacing` property is set to `2 px` for the `body` element. This will display each word by leaving a distance of two pixels. The `text-decoration` property is set to `underline` for the `h3` element. This will underline the heading in the Web page.

Code Snippet 4:

```
body{
word-spacing: 2 px;
}
```

```
h3{  
text-decoration: underline;  
}
```

Figure 4.2 shows an output of heading tag with underline.

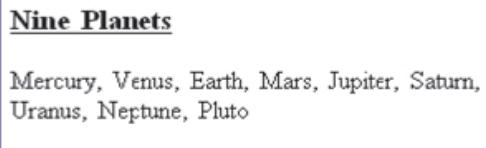


Figure 4.2: Output of Heading Tag with Underline

In Figure 4.2, the header is underlined and each word in the header and the paragraph is displayed by leaving a distance of two pixels between them.

4.3 Inline Span

The `` tag groups inline-elements in a document. For example, if one word in a sentence must be bold or colored without using the `` tag then, a `` tag is used which can be present within an existing tag.

Code Snippet 5 demonstrates CSS inline style for `` tag.

Code Snippet 5:

```
<p>My mother has <span style="color: lightblue">light blue</span> eyes.</p>
```

Or

```
<span class="eyesonly">light blue</span>
```

Code Snippet 6 demonstrates CSS external style for `` tag.

Code Snippet 6:

```
.eyesonly {font-color: lightblue}
```

The `span` tag has different attributes; it supports JavaScript event attributes also. Table 4.8 lists different attributes and values used in `` tag.

Attribute	Value	Description
class	classname	It is used in specifying the text direction for the content in an element.
dir	rtl ltr	It is used in specifying the text direction for the content in an element.
id	id	It is used in specifying a unique id for an element.
lang	language_code	It is used in specifying a language code for the content in an element.
style	style_definition	It is used in specifying an inline style for an element.

Attribute	Value	Description
title	text	It is used in specifying extra information about an element.
xml:lang	language_code	It is used in specifying a language code for the content in an element, in XHTML documents.

Table 4.8: Different Attributes and Values Used in Tag

4.3.1 Indenting Paragraph

Indenting is the process of setting off the text from its normal position, either to the left or to the right. In paragraph style, there are three types of indentation:

- **First line indent** - The text-indent property is used in the CSS for indenting the first line of a paragraph. Code Snippet 7 demonstrates inline style for <p> tag and an internal CSS code for first line indent.

Code Snippet 7:

```
Inline style
<p style="text-indent: 50px">
Internal CSS
p {text-indent: 50px}
```

Code Snippet 8 demonstrates the use of the text-indent property in the HTML file.

Code Snippet 8:

```
<!DOCTYPE HTML>
<html>
  <head>
    <title>Font Gallery</title>
  <style>
    p {text-indent: 150px}
  </style>
  </head>
  <body>
    <p>The font styles properties allow you to specify the font for the text. They allow you to change different font attributes of the text such as font, size, and style of the text. The browser must support the font specified by the font properties. Otherwise, it will display the default font, which is dependent on the browser.</p>
  </body>
</html>
```

Figure 4.3 shows the output of `text-indent` property.

The font styles properties allow you to specify the font for the text. They allow you to change different font attributes of the text such as font, size, and style of the text. The browser must support the font specified by the font properties. Otherwise, it will display the default font, which is dependent on the browser.

Figure 4.3: Output of text-indent Property

- **Padding** - The padding property is used to add a specified amount of space between the border of an element and its contents. Code Snippet 9 demonstrates the inline style for `<p>` tag and an internal CSS code for `padding` property.

Code Snippet 9:

```
Inline style  


Internal CSS  
p {padding: 20px}


```

Code Snippet 10 demonstrates the use of the `text-indent` property in the html file.

Code Snippet 10:

```
<!DOCTYPE HTML>  
<html>  
  <head>  
    <title>Font Gallery</title>  
  <style>  
    p {padding: 20px }  
  </style>  
  </head>  
  <body>  
    <p>  
      The font styles properties allow you to specify the font for the text. They allow you to change different font attributes of the text such as font, size, and style of the text. The browser must support the font specified by the font properties. Otherwise, it will display the default font, which is dependent on the browser.  
    </p>  
  </body>  
</html>
```

Figure 4.4 depicts applying of padding property.

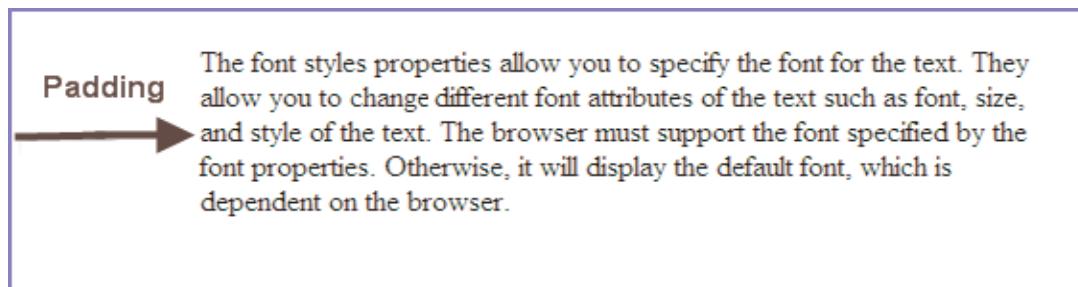


Figure 4.4: Padding Property

- **Margin** - The margin property is used to add a specified amount of whitespace around an element, on the outside of the element.

Code Snippet 11 demonstrates the inline style for `<p>` tag and an internal CSS code for margin property.

Code Snippet 11:

```
Inline style  
<p style="margin: 20px">  
Internal CSS  
p {margin: 20px}
```

Figure 4.5 shows the output of applying margin property.

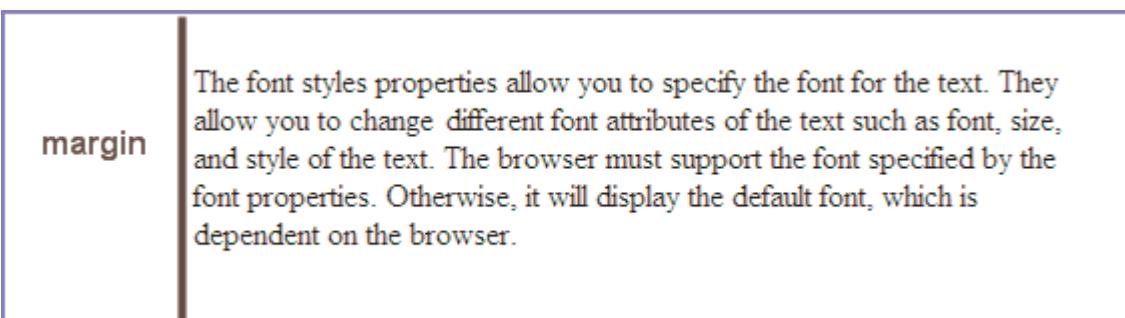


Figure 4.5: Margin Property

4.4 Border Style

Borders are rectangular outlines that surround an element. Borders present around text and an image emphasize the content inside the text box. CSS border properties specify the style, color, and width of the border.

Table 4.9 lists the border-style properties.

border-style Properties		Description
border-left-style		It sets an element's left border.
border-right-style		It sets an element's right border.
border-top-style		It sets an element's top border.
border-bottom-style		It sets an element's bottom border.

Table 4.9: border-style Properties

Table 4.10 lists the values of the border-style properties.

Value	Description
dashed	It is used for specifying a dashed border.
dotted	It is used for specifying a dotted border.
double	It is used for specifying two borders.
groove	It is used for specifying a 3D grooved border.
inset	It is used for specifying a 3D inset border.
outset	It is used for specifying a 3D outset border.
ridge	It is used for specifying a ridged border.
solid	It is used for specifying a solid border.

Table 4.10: Values of the border-style Properties

Code Snippet 12 shows the HTML code to apply border styles.

Code Snippet 12:

```
<!DOCTYPE HTML>
<html>
<head>
<link rel="stylesheet" type="text/css" href="Styles.css" />
<title>MagnaSoftwares</title>
</head>
<body>
<div id="heading">
<h2>Welcome to MagnaSoftwares</h2>
</div>
</body>
</html>
```

Code Snippet 13 shows CSS code for border styles.

Code Snippet 13:

```
#heading
{
background: #FFEFD5;
text-align: center;
border-left-style: ridge;
border-right-style: groove;
border-top-style: dashed;
border-bottom-style: double;
}
```

Explanation for the code:

`border-left-style: ridge;`

Applies a ridged border to the left.

`border-right-style: groove;`

Applies a 3D grooved border to the right.

`border-top-style: dashed;`

Applies a dashed border at the top.

`border-bottom-style: double;`

Applies two borders at the bottom.

Figure 4.6 shows the output of `border-style` properties.



Figure 4.6: Output of `border-style` Properties

Shorthand Property

To make the code concise CSS allows certain shorthand properties. With the help of these shorthand properties the length of the code is reduced. The shorthand property for setting the border is `border-style`.

Code Snippet 14 shows a sample HTML code.

Code Snippet 14:

```
<!DOCTYPE HTML>
<html>
<head>
<link rel="stylesheet" type="text/css" href="Styles1.css"/>
<title>Corpse - World's Largest Flower</title>
```

```
</head>
<body>
<Figure></Figure>
<h2>World's Largest Flower </h2>
<p>Corpse flower is the world's largest flower.<br/>
Its diameter is about a meter. .<br/>
It grows in openings in rainforests on limestone hills of Sumatra, Indonesia.</p>
</body>
</html>
```

Code Snippet 15 shows CSS code for shorthand border-style properties.

Code Snippet 15:

```
.largest_flower
{
border-style: ridge groove dashed double;
}
```

Explanation for the code:

border-style: groove inset outset dashed;

Applies a 3D grooved border at the top, 3D inset border at the right, 3D outset border at the bottom, and dashed border at the left.

Figure 4.7 shows output of shorthand border-style properties.



World's Largest Flower

Corpse flower is the world's largest flower.
Its diameter is about a meter. .
It grows in openings in rainforests on limestone hills of Sumatra, Indonesia.

Figure 4.7: Output of Shorthand border-style Properties

4.4.1 Border Color

The `border-color` property in CSS applies colors to all the four borders. You can also apply four different colors to four borders. There are other border color properties that allow you to individually specify colors of the left, right, top, or bottom border. Table 4.11 lists different border color properties.

Property	Description
<code>border-bottom-color</code>	It is used for specifying the color for the bottom border.
<code>border-left-color</code>	It is used for specifying the color for the left border.
<code>border-right-color</code>	It is used for specifying the color for the right border.
<code>border-top-color</code>	It is used for specifying the color for the top border.

Table 4.11: Different border-color Properties

The `border-color` property accepts different color values that determine different shades of color to be applied to the borders.

Table 4.12 lists the values of different border-color properties.

Value	Description
<code>color</code>	It is used in specifying the color to be applied to the border by using either the RGB or hexadecimal value, or the color name itself.
<code>transparent</code>	It is used for specifying that the border is transparent.

Table 4.12: Values of Different border-color Properties

Code Snippet 16 shows an HTML code demonstrating DIV with border-color properties.

Code Snippet 16:

```
<!DOCTYPE HTML>
<html>
<head>
<link rel="stylesheet" type="text/css" href="StylesNew.css" />
<title>HealthCare</title>
</head>
<body>
<div class="tips">
<h2>Five Essential Health Tips</h2>
<ol>
<li>Quit Smoking</li>
<li>Reduce stress</li>
<li>Protect Yourself from Pollution</li>
<li>Avoid Excessive Drinking</li>
<li>Exercise Regularly</li>
```

```
</ol>
</div>
</body>
</html>
```

Code Snippet 17 shows the CSS code for border-color properties.

Code Snippet 17:

```
.tips
{
border-style: solid;
background: #F1C40F;
border-bottom-color:#E91E63;
border-top-color: #E91E63;
border-right-color: #0000FF;
border-left-color: #0000FF;
}
```

Explanation for the code:

border-bottom-color: #FF0000;

Displays the bottom border in red color.

border-top-color: #FF0000;

Displays the top border in red color.

border-right-color: #0000FF;

Displays the right border in blue color.

border-left-color: #0000FF;

Displays the left border in blue color.

Shorthand Property

The shorthand property for setting the color of the border is border-color.

Code Snippet 18 shows HTML code for a table with border-color properties.

Code Snippet 18:

```
<!DOCTYPE HTML>
<html>
<head>
<link rel="stylesheet" type="text/css" href="Gallery.css" />
<title>Car Gallery</title>
</head>
```

```
<body>
<h2>Car Gallery</h2>
<table border =1>
<tr>
<td><b>Ferrari</b><br/></td>
<td><b>Chevrolet</b><br/></td>
</tr>
</table>
</body>
</html>
```

Code Snippet 19 shows CSS code for shorthand border-color.

Code Snippet 19:

```
body
{
text-align:center;
}
.carmodel
{
border-style: solid;
border-color: Red Blue Green Yellow;
}
```

Explanation for the code:

border-color: Red Blue Green Yellow;

Displays the top border in red, right border in blue, bottom border in green, and left border in yellow color.

4.4.2 Border Width

The border-width property is a shorthand property that specifies the width for all the four borders. There are other border-width properties that allow you to individually specify the left, right, top, or bottom borders. Table 4.13 lists different border-width properties.

Property	Description
border-bottom-width	It is used for specifying the width of the bottom border.
border-left-width	It is used for specifying the width of the left border.
border-right-width	It is used for specifying the width of the right border.
border-top-width	It is used for specifying the width of the top border.

Table 4.13: Different border-width Properties

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The width of the border can be specified or altered by using the predefined values of the border width properties. The values of the border width properties specify the way the border will appear. Table 4.14 lists the values of different border-width properties.

Value	Description
medium	It is used in specifying a medium border.
length	It is used in accepting an explicit value that specifies the thickness of border.
thick	It is used for displaying a thick border.
thin	It is used in specifying a thin border.

Table 4.14: Values of Different border-width Properties

Code Snippet 20 shows the HTML code for border-width properties.

Code Snippet 20:

```
<!DOCTYPE HTML>
<html>
<head>
<link rel="stylesheet" type="text/css" href="banner.css" />
<title>EasyBank</title>
</head>
<body>
<div class="banner">
<h2>EasyBank - Whole World One Bank</h2>
</div>
</body>
</html>
```

Code Snippet 21 shows the CSS code of border-width properties.

Code Snippet 21:

```
.banner
{
text-align:center;
background:#C0C0C0;
border-style:solid;
border-left-style: none;
border-right-style: none;
border-top-width: thick;
border-bottom-width: thick;
font-family: fantasy;
}
```

Explanation for the code:

`border-top-width: thick;`

Displays a thick top border.

`border-bottom-width: thick;`

Displays a thick bottom border.

Figure 4.8 shows the output of `border-width` properties.



Figure 4.8: Output of border-width Properties

Shorthand Property

The shorthand property for setting the border is `border-width`. Code Snippet 22 shows HTML code using the shorthand `border-width` properties.

Code Snippet 22:

```
<!DOCTYPE HTML>
<html>
<head>
<link rel="stylesheet" type="text/css" href="unicef.css" />
<title>UNICEF</title>
</head>
<body>
<h2>About UNICEF</h2>
<p class="aboutus">
UNICEF is an organization that supports and works for children's rights,
development, and protection.
</p>
</body>
</html>
```

Code Snippet 23 shows the CSS code using the shorthand property, border-width.

Code Snippet 23:

```
.aboutus
{
background-color: #FFFFCC;
text-align: justify;
border-style: solid;
border-width: thick thin thick thin;
}
```

Explanation for the code:

border-width: thick thin thick thin;

Specifies a top and bottom border as thick and right and left border as thin.

Figure 4.9 shows output using shorthand code of border-width properties.

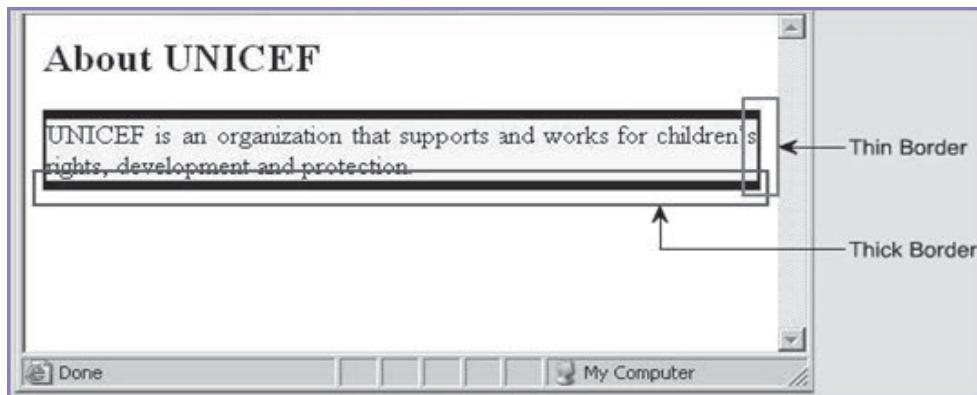


Figure 4.9: Output Using Shorthand Code of border-width Properties

4.4.3 Shorthand Border

The border shorthand property in CSS specifies all the properties such as style, width, and color for all the four borders. It allows the user to specify different properties in just one declaration. You can also set these properties individually by using different shorthand border properties. Table 4.15 lists different shorthand border properties.

Property	Description
border-bottom	It is used in specifying the width, style, and color for the bottom border.
border-left	It is used in specifying the width, style, and color for the left border.
border-right	It is used in specifying the width, style, and color for the right border.
border-top	It is used in specifying the width, style, and color for the top border.

Table 4.15: Different Shorthand Border Properties

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Values of different border properties determine type of effect to be applied to the borders.

Code Snippet 24 shows an HTML code for shorthand border properties.

Code Snippet 24:

```
<!DOCTYPE HTML>
<html>
<head>
<link rel="stylesheet" type="text/css" href="note.css" />
<title>Important Note</title>
</head>
<body>
<h2>Notice</h2>
<div class="impnote">
<ul>
<li>Mobiles are not allowed during class hours.</li>
<li>Each student should carry his/her identity card regularly.</li>
</ul>
</div>
</body>
</html>
```

Code Snippet 25 shows a CSS code using different shorthand border properties.

Code Snippet 25:

```
.impnote
{
background-color: #FFFFCC;
border-top: dashed thin #FF0000;
border-bottom: ridge thick #0000FF;
border-right: dotted thin #FF8040;
border-left: inset medium #FF00FF;
}
ul{
list-style: square;
}
```

Explanation for the code:

`border-top: dashed thin #FF0000;`

Displays a thin top border with a dashed line in red color.

```
border-bottom: ridge thick #0000FF;
```

Displays a thick ridged bottom border in blue color.

```
border-right: dotted thin #FF8040;
```

Displays a thin right border with a dotted line in orange color.

```
border-left: inset medium #FF00FF
```

Displays a medium 3D inset left border in purple color.

Figure 4.10 shows the output of border properties.

Notice:

- Mobiles are not allowed during class hours.
- Each student should carry his/her identity card regularly.

Figure 4.10: Output of Border Properties

Code Snippet 26 shows HTML and CSS code for applying image border property.

Code Snippet 26:

```
<!DOCTYPE HTML>
<html>
<head>
<title>Flower Gallery</title>
<style>
.flower{
border:solid thin #FF0000;
}
</style>
</head>
<body>
<h2>Flower Gallery</h2>
<table>
<tr>
<td></td>
<td valign="top"><h1>Lilac is a species of flowering plants in the olives family. They are shrubs that range from 2 to 10m in height.</h1>
</td>
</tr>
<td></td>
```

```
<td valign="top"><h1>Sunflower is a flowering plant whose stem can grow as high as 3m.</h1>
</td>
</tr>
</table>
</body>
</html>
```

Explanation for the code:

border: solid thin #FF0000;

Specifies that all the four borders must be solid in style, thin by width, and red in color.

Figure 4.11 shows the output of image border property.

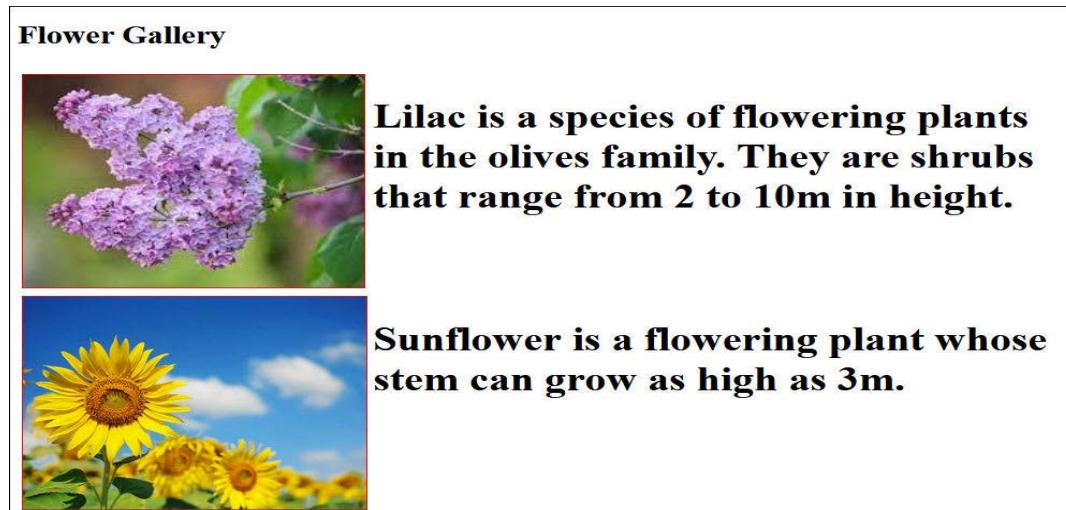


Figure 4.11: Output of Applying Image Border Property

4.5 Horizontal Alignment

In CSS, `text-align` property is used for horizontal alignment of text in an element. This property aligns the inline content of a block.

Table 4.16 lists all values of `text-align` property.

Value	Description
<code>left</code>	Aligns the text to the left.
<code>right</code>	Aligns the text to the right.
<code>center</code>	Centers the text.
<code>justify</code>	Aligns text to both left and right margins by adding space between words (such as in newspapers and magazines).

Value	Description
inherit	Specifies that the value of the text-align property should be inherited from the parent element.

Table 4.16: Values of `text-align` Property

The `text-align` property applies only to block-level elements, such as paragraphs. Hence, `text-align` cannot change the alignment of a single word without changing the alignment of the entire line.

For Western languages, which are read from left to right, the default value of `text-align` is `left`. The text aligns on the left margin and has a ragged right margin. Languages such as Hebrew and Arabic have default align to `right` since, they are read from right to left.

4.6 Vertical Alignment

In CSS, `line-height` property is used for vertical alignment of text in an element. This property is also a component of the ‘font’ shorthand property. It can be applied on block-level elements, table cells, table caption, and so on.

Table 4.17 lists the values of `line-height` property.

Value	Description
normal	A normal line height. This is default.
number	A number that will be multiplied with the current font size to set the line height.
length	A fixed line height in px, pt, cm, and so on.
%	A line height in percent of the current font size.
inherit	Specifies that the value of the line-height property should be inherited from the parent element.

Table 4.17: Values of `line-height` Property

4.7 Selector Specificity

A selector points to the HTML element. In Figure 4.12, the `p` tag is the selector.

```
p {color: yellow}
```

Figure 4.12: Selector

Selector specificity refers to the priority given to a selector on which style declarations will be applied. This indicates that there is a specificity hierarchy for selectors. Following four categories define the specificity level of a selector:

- **Inline styles:** This is attached directly to the element. Example: `<p1 style="color: #ffffff;">`.

- **IDs:** This is a unique identifier for the page elements, such as #firstname.
- **Classes, attributes, and pseudo-classes:** This includes .classes, attributes, and pseudo-classes. A pseudo-class defines a special state of an element such as style of a visited link and unvisited link.
- **Elements and pseudo-elements** - This includes element names and pseudo-elements. A pseudo-element styles specified parts of an element. For example, it can be used to add a special effect to the first line of a text as shown in Figure 4.13.

A short story is a piece of prose fiction that typically can be read in one sitting and focuses on a self-contained incident or series of linked incidents, with the intent of evoking a single effect or mood. The short story is one of the oldest types of literature and has existed in the form of legends, mythic tales, folk tales, fairy tales, fables and anecdotes in various ancient communities across the world. The modern short story developed in the early 19th century.

Figure 4.13: Use of Pseudo-element

Table 4.18 explains the specificity rules with code snippets and outputs.

Rules	Example Code Snippet	Output
If the rule is written twice, the lower rule will be applied.	<pre><!DOCTYPE html> <html> <head> <style> h1 {background-color: red;} h1 {background-color: yellow;} </style> </head> <body><h1>This is my line.</h1> </body> </html></pre>	This is my line.
ID selectors have a higher specificity than attribute selectors.	<pre><!DOCTYPE html> <html> <head> <style> div#a {background-color: yellow;} #a {background-color: blue;} div[id=a] {background-color: red;} </style> </head> <body><div id="a">This is my line.</div> </body> </html></pre>	This is my line.

Rules	Example Code Snippet	Output
Contextual selectors are more specific than a single element selector. (A contextual selector is made up of multiple selectors. Specific style is applied to an element if it is in the specified context.)	<p>CSS file:</p> <pre>#content h1 {background-color: blue;}</pre> <p>HTML file:</p> <pre><style> #content h1 { background-color: red; } </style></pre>	This is my line.
A class selector is given preference to element selectors.	<pre><!DOCTYPE html> <html> <head> <style> .intro {background-color: blue; } h1 {background-color: red; } </style> </head> <body> <h1 class="intro">This is my line.</h1> </body> </html></pre>	This is my line.

Table 4.18: Specificity Rules

4.8 Pseudo Selectors

A pseudo-class selector defines a particular state of an element. There are many pseudo-class selectors. Some of the common selectors include link-related, number-based, and text-related pseudo-class selectors. A colon precedes these selectors.

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Table 4.19 describes two pseudo-class selectors using example code and outputs.

Pseudo-Class Selectors	Example Code	Output
:hover	<pre><!DOCTYPE html> <html> <head> <style> div { background-color: green; color: white; padding: 25px; text-align: center; } div:hover { background-color: blue; } </style> </head> <body> <div>Place the mouse over here to change the color.</div> </body> </html></pre>	<p>(Before Mouse Over)</p> <p>Place the mouse over here to change the color.</p> <p>(After Mouse Over)</p> <p>Place the mouse over here to change the color.</p>
:before	<pre>#para{ font-size: 18px; } #para::before{ content: "- BEFORE -"; background-color: green; } #para::after{ content: "- AFTER -"; background-color: green;</pre>	- BEFORE -first paragraph- AFTER -

Table 4.19: Examples of Pseudo-class Selectors

Table 4.20 describes certain other pseudo-class selectors.

Pseudo-class Selector	Description
:active	Use this for an element that a user activates, such as by clicking the mouse. Usage: a:active

Pseudo-class Selector	Description
:focus	Use this for an element that receives focus, such as when a user clicks an element. Usage: <code>input:focus</code>
:disabled	Use this for a disabled element, such as that cannot be clicked or selected. Usage <code>input:disabled</code>
:visited	Use this for all visited links. Usage: <code>a:visited</code>
:link	Use this for all unvisited links. Usage: <code>a:link</code>

Table 4.20: Certain Other Pseudo-class Selectors

4.9 CSS Combinators

A combinator is used with multiple simple selectors, such as `h2 + p`. It indicates the relationship between selectors.

Table 4.21 describes the CSS combinators.

CSS Combinator	Symbol	Description
Descendant selector	(space)	Consider <code><Element_1> <Element_2></code> . This selects all <code><Element_2></code> elements inside <code><Element_1></code> .
Child selector	<code>></code>	Consider <code><Element_1> > <Element_2></code> . This selects all <code><Element_2></code> elements where the parent is <code><Element_1></code> .
Adjacent sibling selector	<code>+</code>	Consider <code><Element_1> + <Element_2></code> . This selects the first <code><Element_2></code> element that are placed immediately after <code><Element_1></code> .
General sibling selector	<code>~</code>	Selects each <code></code> element that are preceded by a <code><p></code> element.

Table 4.21: CSS Combinators

Code Snippet 27 shows how to use the adjacent sibling selector.

Code Snippet 27:

```

<html>
<head>
<style>
div + p {
    background-color: gray;
}

```

```
</style>
</head>
<body>
<h2>Example of Adjacent Sibling Selector</h2>
<div>
    <p>This is the first line.</p>
    <p>This is the second line.</p>
</div>
<p>This is the third line.</p>
<p>This is the fourth line.</p>
<div>
    <p>This is the fifth line.</p>
    <p>This is the sixth line.</p>
</div>
<p>This is the seventh line.</p>
<p>This is the eighth line.</p>
</body>
</html>
```

Figure 4.14 shows the output.

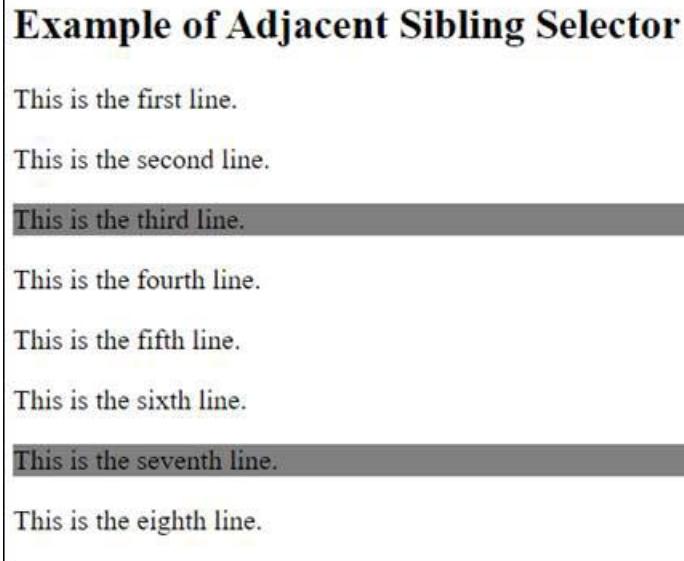


Figure 4.14: Output of Using Adjacent Sibling Selector

4.10 Box Model

The box model refers to the design and layout of HTML element. It includes margins, borders, padding, and content of the element. Following describes each component:

- ➔ **Margins:** They extend the border area.
- ➔ **Borders:** They surround the padding area.

- **Padding:** It is the clear area around the content.
- **Content:** It refers to text and images.

It is important to know about box model so that elements are displayed well in all browsers with respect to height and width. Besides the content area, it is important to consider padding, margins, and borders.

Code Snippet 28 shows an example of defining padding and border for the content.

Code Snippet 28:

```
<!DOCTYPE html>
<html>
<head>
<style>
div {
    width: 100px;
    border: 5px solid red;
    padding: 10px;
    margin: 0;
}
</style>
</head>
<body>
<div>Hi! Check the padding and border</div>
</body>
</html>
```

Figure 4.15 shows the output.



Figure 4.15: Output of Code Snippet 28

Figure 4.16 shows the output when the value of padding is changed to 25 px and border is changed to 10 px.



Figure 4.16: Output After Changing Padding

4.11 Positioning

One should use the position property to define the positioning method for an element.

Following is the syntax for the property:

```
position: static|absolute|fixed|relative|sticky
```

Table 4.22 describes some of the important values of position property.

Property	Description
static	<p>Displays elements in the order given in the document.</p> <p>Example:</p> <div style="border: 1px solid black; padding: 5px;"><p>This line uses the static position.</p><p>This is the second line. When no position is specified, static becomes the default position.</p></div>
absolute	<p>Positions element relative to its closest positioned ancestor element.</p> <p>Example:</p> <div style="border: 1px solid black; padding: 5px;"><p>This is the closest parent element.</p><p>This is the relative position.</p></div>
fixed	<p>Positions element relative to the browser window. It is commonly used to place a fixed menu bar.</p> <p>Example:</p> <div style="border: 1px solid black; padding: 5px;"><p>Home News Contact</p><p>The menu bar above uses the fixed position</p><p>Scrolling will not affect the bar.</p><p>Scroll down to check</p><p>This is line 1. This is line 2. This is line 3.</p></div>

Property	Description
relative	<p>Positions element based on its current position without changing layout.</p> <p>Example:</p> 
sticky	<p>Positions element based on the scroll position.</p> <p>Example:</p> <p>Example of Relative Position</p> <p>This is the normal position.</p> <p>This is the relative position, which is moved to right</p>

Table 4.22: Position Property

To specify the stack order of an element, that is, if it should be placed before or after an element, the z-index property is used. Code Snippet 29 shows an example of using the property.

Code Snippet 29:

```
div.first{
    background-color:black;
    left: 50px;
    z-index: 10;
}
```

Figure 4.17 shows the output, where FIRST ELEMENT is specified to be placed on the top.



Figure 4.17: Output of z-index Property

4.12 Float

Consider an arrangement of text and image as shown in Figure 4.18.



The two types of pollination are: self-pollination and cross-pollination. Self-pollination happens when the pollen from the anther is deposited on the stigma of the same flower, or another flower on the same plant. Cross-pollination is the transfer of pollen from the anther of one flower to the stigma of another flower on a different individual of the same species.

Figure 4.18: Arrangement of Text and Image

Note that in Figure 4.18, image is shown on the left and the text is shown on the right. Such kind of arrangement can be shown using the float property. Use the property to position and format content. Table 4.23 describes the values for the float property.

Property	Description
left	Floats the element to the left.
right	Floats the element to the right.
none	Is default. The element does not float.
inherit	Inherits the float value of its parent.

Table 4.23: Float Property

Following is the syntax of the float property:

```
float: none|left|right|initial|inherit;  
Code Snippet 30 shows the code for Figure 4.18.
```

Code Snippet 30:

```
<!DOCTYPE html>
<html>
<head>
<style>
img {
  float: left;
}
</style>
</head>
<body>
<p>
The two types of pollination are: self-pollination and cross-pollina-
tion. Self-pollination happens when the pollen from the anther is deposit-
ed on the stigma of the same flower, or another flower on the same plant.
Cross-pollination is the transfer of pollen from the anther of one flower
to the stigma of another flower on a different individual of the same spe-
cies.</p>
</body>
</html>
```

4.13 Check Your Progress

1. The _____ and _____ properties provide different values that allow the user to specify the decoration and word spacing of text in an element.

(A)	word-spacing	(C)	line-height
(B)	text-decoration	(D)	text-align

2. The tag _____ inline-elements in a document.

(A)	Right aligns	(C)	Groups
(B)	Left aligns	(D)	Deletes

3. Which border property specifies different properties in just one declaration?

(A)	border-bottom-color	(C)	border-right-width
(B)	border-bottom	(D)	border-left

4. Match the value against the description:

Value		Description	
(A)	medium	(1)	Specifies a thin border.
(B)	length	(2)	Specifies a thick border.
(C)	thick	(3)	Accepts an explicit value that specifies the thickness of border.
(D)	thin	(4)	Specifies a medium border. This is the default value.

(A)	a-2, b-1, c-3, d-4	(C)	a-4, b-1, c-2, d-3
(B)	a-1, b-2, c-3, d-4	(D)	a-4, b-3, c-2, d-1

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5. Match the following:

Property		Description	
(A)	border-bottom-color	(1)	Specifies the color for the right border.
(B)	border-left-color	(2)	Specifies the color for the top border.
(C)	border-right-color	(3)	Specifies the color for the bottom border.
(D)	border-top-color	(4)	Specifies the color for the left border.

(A)	a-3, b-4, c-1, d-2	(C)	a-4, b-3, c-2, d-1
(B)	a-1, b-2, c-3, d-4	(D)	a-2, b-1, c-4, d-3

6. What is the default text alignment for Hebrew and Arabic languages?

(A)	Left	(C)	Right
(B)	Center	(D)	Justify

7. Which one of the following options describes the clear area around the content?

(A)	Margins	(C)	Padding
(B)	Borders	(D)	Float

4.13.1 Answers

1.	A, B
2.	C
3.	B, D
4.	D
5.	A
6.	C
7.	C

Summary

- The text styles specify and control the appearance of the text in a Web page.
- Indenting is the process of offsetting text from its normal position, either to the left or to the right.
- CSS border properties specify the style, color, and width of the border.
- The border-color property accepts different color values that determine different shades of color to be applied to borders.
- Values of different border properties determine the type of effect to be applied to the borders.
- In CSS, the text-align property is used for horizontal alignment of text in an element.
- In CSS, the line-height property is used for vertical alignment of text in an element.
- Selector specificity can be used to prioritize a selector on which style declarations will be applied.
- A pseudo-class selector defines a particular state of an element.
- A combinator indicates the relationship between selectors.
- It is important to know about box model so that elements are displayed well in all browsers with respect to height and width.
- The position property can be used to position and format content.

Try It Yourself

1. Mathew wants to develop a Web page on his biblical findings. For writing major quotes of the bible verses he wants blue bordered text box with center alignment of the content and for its explanation he wants text box with red colored text that would be vertically center aligned. Use CSS code to create this Web page.



Session - 5

Displaying Graphics and CSS3 Animation

Welcome to the Session, **Displaying Graphics and CSS3 Animation**.

This session explains formatting of graphics, insertion, sizing, and padding of graphics in Web pages. This session also explains CSS3 animation and how CSS3 can be used on Mobiles.

In this Session, you will learn to:

- ➔ Explain graphic formatting in Web pages
- ➔ Explain graphic insertion, sizing, and padding
- ➔ Explain CSS3 Animation
- ➔ Describe the use of CSS3 on mobile devices

5.1 Introduction

After the release of HTML5 and CSS3 in the market, most of the Web designers are developing graphics based Web page. CSS3 has allowed the designers to style their Web pages graphically with ease. Currently, HTML5 applications provide amazing experiences with the use of new CSS3 animations. The introduction of mobile applications has allowed the users to expand their Web usage to mobile devices. CSS3 has introduced new features specifically for mobile devices.

5.2 Graphic Format

There are many graphic formats available; the most commonly used are Joint Photographic Experts Group (JPEG), Graphics Interchange Format (GIF), and Portable Network Graphics (PNG).

Difference between each graphic format depends on following characteristics:

- **Color Depth** – It is defined by the number of distinct colors that are represented by a hardware or software. Color depth is defined by the number of bits per pixel (bpp) and it is also called as bit depth. Higher the color depth indicates higher range of colors used.
- **Compression/file size** – Graphic files are large, so images are compressed using various techniques. Compression stores the original images in a reduced number of bytes using an algorithm. This image can be expanded back to the original size using a decompression algorithm. In some compression formats, images with less complexity results in smaller compressed file sizes.

The two types of image file compression algorithms used are as follows:

- **Lossless compression** – In this algorithm, file size is reduced but preserves a copy of the original uncompressed image. Lossless compression avoids accumulating stages of re-compression when editing images.
 - **Lossy compression** – In this algorithm, a representation of the original uncompressed image is preserved. The image appears to be a copy of the original image but in actuality it is not a copy. Lossy compression achieves smaller file sizes when compared with lossless compression. Generally, lossy compression algorithms allow variable compression that comprises on image quality for file size.
- **Animation** – Some graphic format consists of a series of frames that are played one after the other giving an impression of animation. Animated graphics are typically used on a Web page to attract visitor's attention.

Figure 5.1 shows an animated graphic.

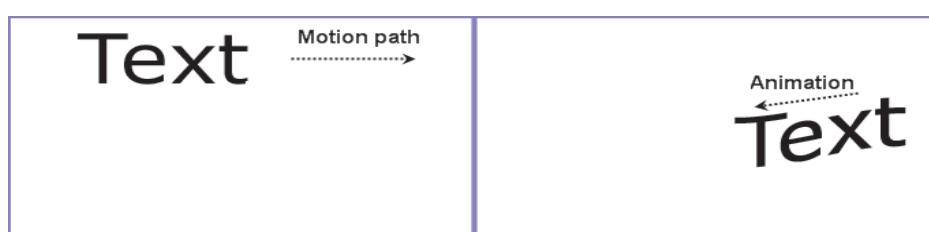


Figure 5.1: Animated Graphic

- **Transparency** – It is very common on the Web to display an image on a Web page that appears directly against the background color of the page. The background color of the Web page shows

through the transparent portion of the image. In a transparent image, one and only one color can be hidden. If the color chosen to make transparent is same as the background of the inserted image, then, an irregularly shaped image appears to float on the page. Figure 5.2 shows a transparent image.

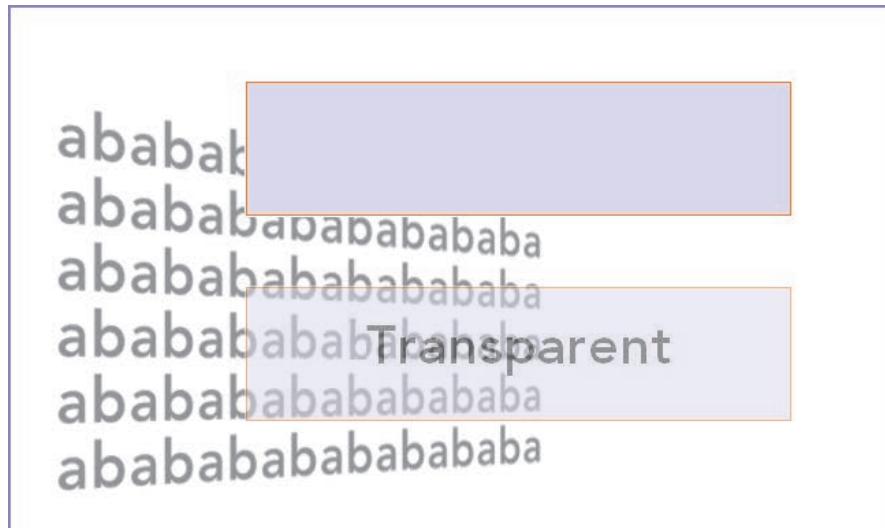


Figure 5.2: Transparent Image

5.2.1 Graphic Format for the Web

For Web pages, use of JPEG and PNG graphics are recommended as it provides maximum compatibility with all devices that might be accessing a Web page. For photos, use of JPEG graphic format and for screen-shots and drawings use of PNG graphic format is recommended. Both these formats compress the picture information to reduce the download time and increase the downloading speed.

- **JPEG** - It uses a lossy compression which means that the image quality is lost in the process of compressing the image. It is recommended that for continuous tone pictures such as photos JPEG should be used. Most JPEG editor allows the user to specify the amount of detail that the user is prepared to lose. If the quality is reduced then, the loss is visible; JPEG is about half the size of PNG.
- **PNG** - It uses lossless compression, which means there is no loss of any image detail. PNG was designed for transferring images on the Internet and not for professional-quality print graphics; therefore it does not support non-RGB color spaces such as CMYK. It supports high color and partial transparency using alpha channels.

Note - An alpha channel is a special type of channel used in graphics software for saving selections.

- **GIF** - It uses a lossless compression which means that there is no loss in quality when the image is compressed. The uncompressed image stores its information in a linear fashion. Each line of pixels is read from left to right. An interlaced GIF file stores the lines of the image in a different order. Animated graphics are stored in gif format.

Compatibility and appearance are the keywords on the Web. The inserted images must be visible and undistorted when appearing on any recipient's device. The Web designer can make assumptions that the Website will open in a computer which will have minimum resolution of 800x600 pixel display capability. If a mobile based Web page has to be created then, the specifications will change.

5.2.2 Graphic Insertion

The `IMG` element is an empty element, which allows the user to insert an image in a Web page. It allows insertion of images and diagrams. Commonly used graphic formats that are supported are namely, GIF, JPEG, BITMAP (BMP), and PNG. The `` tag reserves a space for the image and does not insert the image in the HTML page. It creates a link between the image and the HTML page.

Table 5.1 lists commonly used attributes of `IMG` element.

Attributes	Description
<code>src</code>	Specifies the path of an image that is to be displayed.
<code>height</code>	Specifies the height of an image.
<code>width</code>	Specifies the width of an image.

Table 5.1: Commonly Used Attributes of IMG Element

Code Snippet 1 demonstrates how to display an image in a Web page using the `IMG` element.

Code Snippet 1:

```
<body>

</body>
```

The code uses the `src` attribute of the `IMG` element to insert a `JPEG` image. The attribute specifies the name of the image and also indicates that the image is present in the same folder where the HTML file is saved. The `width` and `height` of the image is set to 225 and 151 pixels respectively by using the `width` and `height` attribute. A pixel refers to the smallest dot on the monitor screen.

An image can also be stored in a subfolder of the folder containing the HTML file. In such cases, a reference to the image is made by using the sub folder name as shown in Code Snippet 2.

Code Snippet 2:

```
<body>

</body>
```

To align the image the `float` style attribute can be used to specify the inline style for the element. This will force the image to be aligned to the left or right of the screen and wrap the surrounding text around the image. Code Snippet 3 demonstrates the use of the `float` style.

Code Snippet 3:

```
<body>

</body>
```

Table 5.2 lists the values of float property in the `` tag.

Value	Description
left	The element floats to the left.
right	The element floats to the right.
none	The element does not float and is the default value.
inherit	The element specifies that the value of the float property should be inherited from the parent element.

Table 5.2: Values of Float Property in `` Tag

HTML5 introduced a new `<Figure>` tag. The `<Figure>` tag acts as a container containing the `` tag. In other words, it is not a replacement for `` tag, but acts as a container into which the `` tag is placed. The `<Figure>` tag specifies self-contained content, such as illustrations, diagrams, photos, code listings, and so on.

While the content of the `<Figure>` element is related to the main flow, its position is independent of the main flow, and if removed it does not affect the flow of the document.

Code Snippet 4 demonstrates the use of `<Figure>` tag.

Code Snippet 4:

```
<Figure>

width="304" height="228" />
</Figure>
```

The main advantage of using `<Figure>` tag is that it allows the user to use the `<figcaption>` tag along with it. The `<figcaption>` tag allows the user to add a caption to the image. The caption always appears along with the image even if the image floats in Website layout.

Code Snippet 5 demonstrates the use of `<figcaption>` tag.

Code Snippet 5:

```
<Figure>

<figcaption>This diagram shows the logo of a product.</figcaption>
</Figure>
```

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The <Figure> tag can also assign styles and other attributes to the <Figure> element using an external or internal style sheet. A single caption to a group of images can be added using the <Figure> tag.

Code Snippet 6 demonstrates how to assign a single caption to a group of images.

Code Snippet 6:

```
<Figure>



<figcaption>The different types of flowers</figcaption>
</Figure>
```

Figure 5.3 shows output of a single caption to a group of images.



Figure 5.3: A Single Caption to a Group of Images

5.2.3 CSS Image Sizing and Padding

Size of an image is specified in pixels. The height and width property sets height and width of the image respectively. One can specify width and the height will be resized or vice versa.

Note - The height and width property does not include padding, borders, or margins.

Code Snippet 7 demonstrates CSS code for setting the image height and width property.

Code Snippet 7:

```
p.ex
{
height:100px;
width:100px;
}
```

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Table 5.3 lists different CSS properties and values of images.

Property	Description	Values
height	Sets the height of an element	<ul style="list-style-type: none">• Auto• Length• %• inherit
max-height	Sets the maximum height of an element	<ul style="list-style-type: none">• none• length• %• inherit
max-width	Sets the maximum width of an element	<ul style="list-style-type: none">• none• length• %• inherit
min-height	Sets the minimum height of an element	<ul style="list-style-type: none">• length• %• inherit
min-width	Sets the minimum width of an element	<ul style="list-style-type: none">• length• %• inherit
width	Sets the width of an element	<ul style="list-style-type: none">• auto• length• %• inherit

Table 5.3: Different CSS Properties and Values of Images

Table 5.4 list various values used with height and width properties.

Value	Description
auto	The browser calculates the height and is the default value
length	Defines the length in pixels (px)
%	Defines the height of the containing block in percent format
inherit	Specifies that the value of the property should be inherited from the parent element

Table 5.4: Various Values Used in Height and Width Properties

Padding

The CSS padding property is used to specify the space between the element border and the element content. It is used to separate them from the surrounding element. The background color of the element affects the padding property. Using separate properties such as top, right, bottom, and left, different padding values can be specified and the padding can be changed separately.

Table 5.5 list various values used in padding property.

Value	Description
length	This property specifies a fixed value for padding in pixels, pt, em, and so on
%	This property specifies a value for padding in % of the containing element

Table 5.5: Various Values used in Padding Property

Code Snippet 8 demonstrates the CSS code used for specifying different padding values for different sides.

Code Snippet 8:

```
padding-top:10px;  
padding-bottom:10px;  
padding-right:15px;  
padding-left:15px;
```

In the code, the value for padding was set for all the sides.

Instead of using different padding for different sides, users can use a shorthand property. A shorthand property is one where all the padding properties for different sides are specified in one property. This will result in a shortened code.

The shorthand property for all the padding properties is padding. The property can be used to specify one to four values for each of the side. Code Snippet 9 demonstrates the use of the shorthand property for padding.

Code Snippet 9:

```
padding:25px 50px 75px 100px;
```

where, top padding is 25 px, right padding is 50 px, bottom padding is 75 px, and left padding is 100 px.

Table 5.6 lists all CSS padding properties.

Property	Description
padding	The browser calculates the height and is the default value
padding-bottom	Defines the length in pixels (px)
padding-left	Defines the height of the containing block in percent format
padding-right	Specifies that the value of the property should be inherited from the parent element

Property	Description
padding-top	Sets the top padding of an element

Table 5.6: CSS Padding Properties

5.3 Thumbnail Graphics

The speed of loading a page of a Website is reduced if high-resolution graphics are used. High-resolution graphics are required to improve the effectiveness of the site and cannot be avoided. Hence, to avoid this issue, thumbnails are used.

A thumbnail is a small image, or a part of a larger image. Clicking the thumbnail image will link to the larger original image, which can be viewed and downloaded. Even a hover effect can be given through CSS and JavaScript.

Code Snippet 10 demonstrates an HTML code for inclusion of a thumbnail image.

Code Snippet 10:

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="utf-8">
<title>Thumbnail</title>
<style>
/* general */
body {
    margin:0;
    padding:40px 80px;
    background:#fff;
    font:70% Arial, Helvetica, sans-serif;
    color:#555;
    line-height:100%;
}
h1, h2{
    font-size:180%;
    font-weight: normal;
    color:#555;
}
p{
    margin:1em 0;
}
```

```
p.text{  
    width:500px;  
}  
  
a{  
    color:#f20;  
    text-decoration:none;  
}  
  
a:hover{  
    color:#999;  
}  
  
img{  
    border:none;  
}  
  
/* // general */  
/* thumbnail list */  
ul#thumbs, ul#thumbs li{  
    margin:0;  
    padding:0;  
    list-style:none;  
}  
  
ul#thumbs li{  
    float:left;  
    margin-right:0px;  
    border:1px solid #999;  
    padding:2px;  
}  
  
ul#thumbs a{  
    display:block;  
    float:left;  
    width:125px;  
    height:135px;  
    line-height:50px;  
    overflow:hidden;  
    position:relative;  
    z-index:1;  
}
```

```
ul#thumbs a img{
    float:left;
    position:absolute;
    top:0px;
    left:0px;
}
/* mouse over */
ul#thumbs a:hover{
    overflow:visible;
    z-index:1000;
    border:none;
}
ul#thumbs a:hover img{
    border:1px solid #999;
    background:#fff;
    padding:2px;
}
/* // mouse over */
/* clearing floats */
ul#thumbs:after, li#thumbs:after{
    content:".";
    display:block;
    height:0;
    clear:both;
    visibility:hidden;
}
ul#thumbs, li#thumbs{
    display:block;
}
ul#thumbs, li#thumbs{
    min-height:1%;
}
* html ul#thumbs, * html li#thumbs{
    height:1%;
}
```

```
/* // clearing floats */
/* // thumbnail list */
</style>
</head>

<body>
    <h2>Thumbnail</h2>
    <ul id="thumbs">
        <li><a href="HTML5.png" target="_blank"></a></li>
    </ul>
</body>
</html>
```

Figure 5.4 shows output of thumbnail with hover effect.



Figure 5.4: Output of Thumbnail with Hover Effect

5.4 Working with CSS3 Transitions

Interactivity is one of the important aspects of animation. Earlier, a combination of HTML, CSS, and JavaScript were used to animate objects on the Web. In 2007, Apple introduced the CSS transition, which later became a proprietary feature of Safari called CSS Animation. Representatives from Apple and Mozilla

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began adding the CSS transitions module to the CSS Level 3 specification, closely modeled on what Apple had already added to Webkit and moz.

All browsers do not support CSS3 transitions, only some do. Browsers that support CSS3 Transitions are as follows:

- Apple Safari 3.1 and later which requires the prefix `-webkit-`
- Google Chrome which requires the prefix `-webkit-`
- Mozilla Firefox 3.7 alpha and later which requires the prefix `-moz-`
- Opera 10.5x and later which requires the prefix `-o-`

For performing CSS transitions, two required specifications include CSS property that requires the effect and duration of the effect.

Code Snippet 11 demonstrates the use of transition effect on the `width` property for three seconds.

Code Snippet 11:

```
div
{
transition: width 3s;
-moz-transition: width 3s; /* Firefox 4 */
-webkit-transition: width 3s; /* Safari and Chrome */
-o-transition: width 3s; /* Opera */
}
```

The effect will start when the specified CSS property changes value. The CSS property changes its value typically when a user moves a mouse over an element. Thus, the user can set the hover for `<div>` elements. Code Snippet 12 demonstrates the same.

Code Snippet 12:

```
div:hover
{
width:200px;
}
```

Table 5.7 lists all the transition properties.

Property	Description
<code>transition</code>	Is a shorthand property and is used for setting the four transition properties into a single property
<code>transition-property</code>	Is used for specifying the name of the CSS property for which the transition value is set

Property	Description
transition-duration	Is used for defining the duration of the transition. Default value is 0
transition-timing-function	Is used for describing how the speed during a transition will be calculated. Default value is "ease"
transition-delay	Is used for defining the start of the transition. Default value is 0

Table 5.7: Transition Properties

Code Snippet 13 demonstrates an HTML and CSS code using all transition properties.

Code Snippet 13:

```
<!DOCTYPE html>
<html>
<head>
<style type="text/css">
div
{
width:100px;
height:100px;
background:#000000;
transition-property:width;
transition-duration:2s;
transition-timing-function:linear;
transition-delay:1s;
/* Firefox 4 */
-moz-transition-property:width;
-moz-transition-duration:2s;
-moz-transition-timing-function:linear;
-moz-transition-delay:1s;
/* Safari and Chrome */
-webkit-transition-property:width;
-webkit-transition-duration:2s;
-webkit-transition-timing-function:linear;
-webkit-transition-delay:1s;
}
div:hover
```

```
{  
width:500px;  
}  
</style>  
</head>  
<body>  
<p><b>Note:</b> The example</p>  
<div></div>  
<p>Hover over the div element above, to see the transition effect.</p>  
<p><b>Note:</b> The transition effect will wait 1 second before starting.</p>  
</body>  
</html>
```

Figure 5.5 shows output of all transition properties.

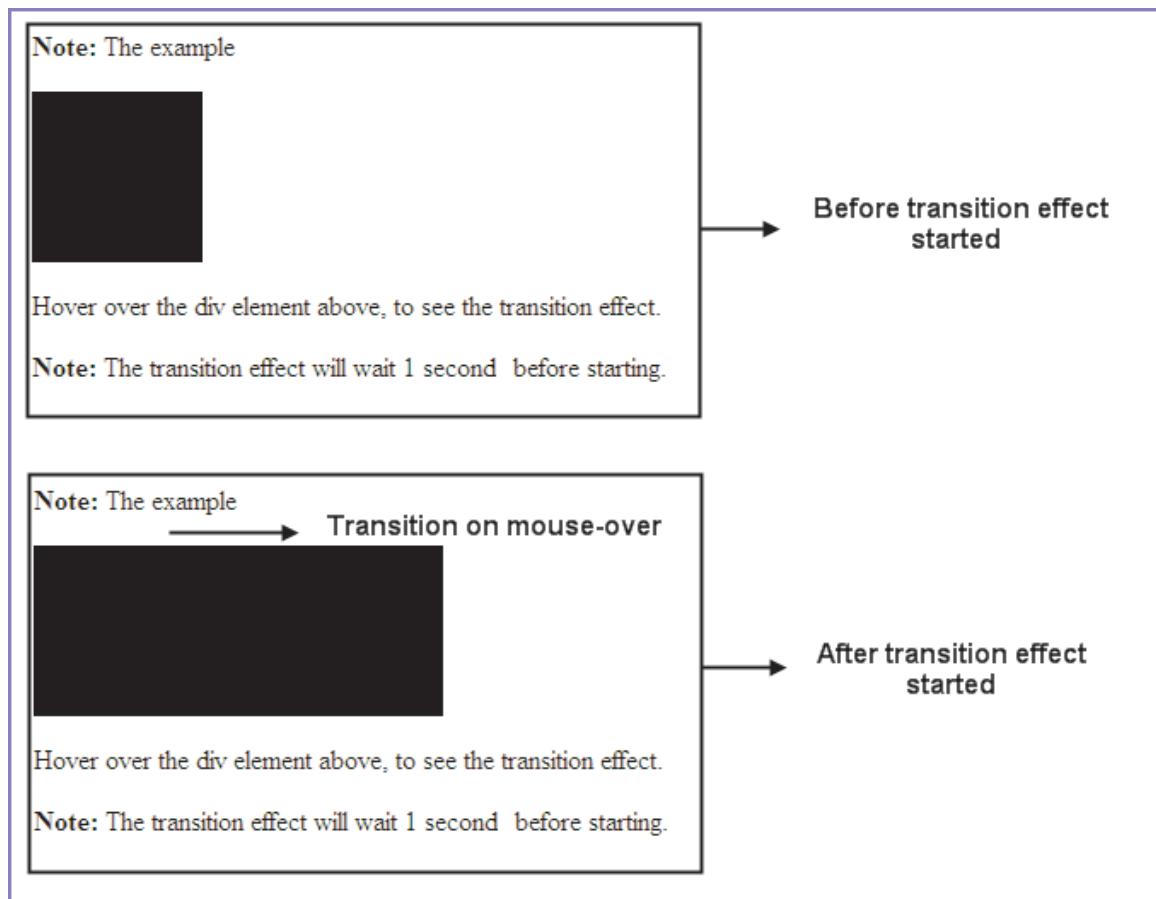


Figure 5.5: Output of all Transition Properties

5.5 CSS3 Animation

CSS3 animations can animate transitions of one CSS style configuration to another. The two components of animation are as follows:

- An animation style describing the animation.
- A keyframes set that specifies the start and end states of the animation's CSS style and possible intermediate waypoints along the way.

The three advantages to CSS3 animations over script-based animation techniques are as follows:

1. Easy to use and anybody can create them without the knowledge of JavaScript.
2. Executes well even under reasonable system load. As simple animations perform poorly in JavaScript, the rendering engine uses the frame-skipping techniques to allow smooth flow of animation.
3. Allows the browser to control the animation sequence, optimize performance and efficiency by reducing the update frequency of animations executing in tabs that aren't currently visible.

5.5.1 Configuring the Animation

A CSS animation sequence can be created by styling the element with the `animation` property. This property can be used to configure the timing, duration, and sequence of the animation. `@keyframes` rule define the appearance of the animation. The keyframe is used to describe the rendering of the element in the animation sequence.

Table 5.8 lists the `@keyframes` rule and all the animation properties.

Property	Description
<code>@keyframes</code>	Is used for specifying the animation
<code>animation</code>	Is a shorthand property representing all the animation properties, except the <code>animation-play-state</code> property
<code>animation-name</code>	Is used for specifying the name of the <code>@keyframes</code> animation
<code>animation-duration</code>	Is used for specifying the duration of an animation cycle in seconds or milliseconds. Default value is 0
<code>animation-timing-function</code>	Is used for describing the progress of animation over one cycle of its duration. Default value is 'ease'
<code>animation-delay</code>	Is used for specifying the start value of animation. Default value is 0
<code>animation-iteration-count</code>	Is used for specifying the number of times an animation is played. Default value is 1
<code>animation-direction</code>	Is used for specifying whether or not the animation should play in reverse on alternate cycles. Default value is 'normal'
<code>animation-play-state</code>	Is used for specifying the state of the animation, that is whether it is running or paused. Default value is 'running'

Table 5.8: `@keyframes` Rule and all the Animation Properties

The syntax for @keyframes is as follows:

Syntax:

```
@keyframes myfirst
{
from {background: red;}
to {background: yellow;}
}
@-moz-keyframes myfirst /* Firefox */
{
from {background: red;}
to {background: yellow;}
}
@-webkit-keyframes myfirst /* Safari and Chrome */
{
from {background: red;}
to {background: yellow;}
}
```

The animation created using @keyframes must be bound with the selector for effective execution. For this, specify name of the animation and duration of animation to the selector.

Code Snippet 14 demonstrates HTML and CSS code of @keyframes rule and all the animation properties.

Code Snippet 14:

```
<!DOCTYPE html>
<html>
<head>
<style type="text/css">
div
{
width:200px;
height:200px;
background:red;
position:relative;
border-radius:100px;
animation-name:myfirst;
animation-duration:4s;
animation-timing-function:linear;
animation-delay:1s;
animation-iteration-count:infinite;
animation-direction:alternate;
animation-play-state:running;
}
```

```
/* Firefox: */
0% {background:red; left:0px; top:0px; }
25% {background:yellow; left:200px; top:0px; }
50% {background:blue; left:200px; top:200px; }
75% {background:green; left:0px; top:200px; }
100% {background:red; left:0px; top:0px; }
}
</style>
</head>
<body>
<p><b>Note:</b> Animation</p>
<div></div>
</body>
</html>
```

Figure 5.6 shows the output of @keyframes rule and all the animation properties.

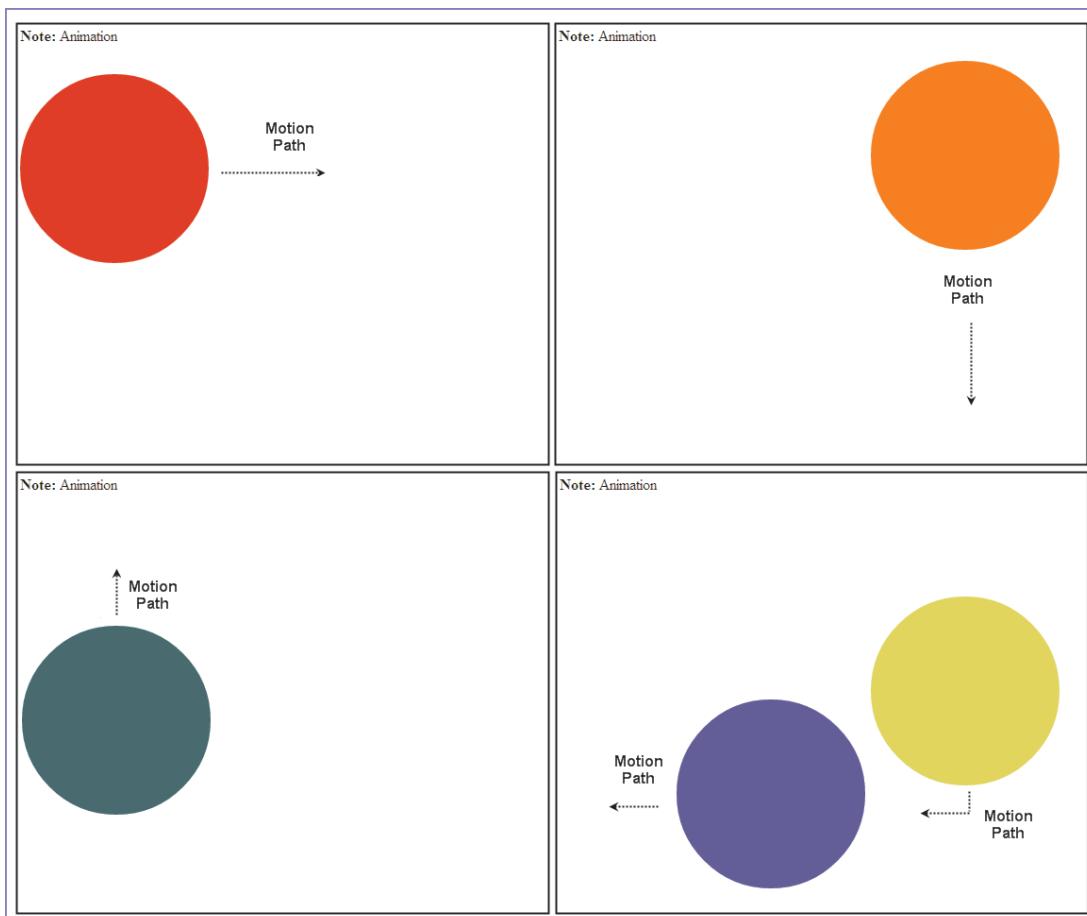


Figure 5.6: Output of @keyframes Rule and all the Animation Properties

5.6 Using CSS3 on Mobile Devices

There are different ways to provide Web pages for mobile devices. The user can make use of style sheet for the handheld devices (all mobile browsers do not recognize it). iPhone's Safari and Opera's Mini browsers support a new feature of CSS3 called media queries. These queries allow the user to specify a conditional expression for media type. Code Snippet 15 shows the use of a conditional expression for displaying a link element where the maximum screen width for mobile devices is 480 pixels.

Code Snippet 15:

```
<link rel="stylesheet" href="styles/mobile.css" media="only screen and (max-device-width: 480px)"/>
```

Next, the user can also specify another link element for screen media with a minimum screen width of 481 pixels. In other words, the style sheet for this element can be used for standard computer screens.

Separate Websites must be developed for mobile devices. The home page of the main site should provide a link that connects to the mobile Website. This technique identifies mobile device of the user and renders the mobile Website automatically in the best view possible. Most mobile Websites are created to precede the domain name of the main site with m, for example, **m.contoso.com**.

To detect a mobile device, a Website can use JavaScript on the client, a scripting language on the server, or Wireless Universal Resource File (WURFL) on the server.

Five ways to provide Web pages for mobile devices are as follows:

- Define a style sheet for mobile devices
- Include a link to a mobile version of the Website
- Use JavaScript to detect mobile devices and redirect
- Use a server-side scripting language to detect and redirect
- Use the WURFL to detect mobile devices

Note - WURFL is a community effort focused on mobile device detection. WURFL is a set of proprietary APIs and an XML configuration file which contains information about device capabilities and features for a variety of mobile devices.

5.7 Coding for Optimum Browser Compatibility

Web browser compatibility measures are undertaken by Web developers who are committed to producing Web products that provide predictability and consistency across the preferable Web browsers of the targeted end users.

Cross browser compatibility means a Website that is attuned and reliable in looks, layout, color, functionality, interactivity, and proportion across all existing Web browsers, regardless of the browsers'

insignificance or popularity differences from version to version. Multi-browser compatibility is constant and it is functionally rendered across the most commonly used browsers in a client's target market. HTML5 uses different standards and is supported by various browsers. These browsers provide different version of support.

Rendering engines are a set of tools that are used in most browsers that supports different HTML features. Some of the rendering engines of different browsers are as follows:

- **Gecko** - The Gecko engine is the main engine of Mozilla Firefox, and a number of related browsers. It has support for various HTML5 features. Although, Firefox is an eminent and highly appreciated browser in the Web development community, it does not yet have the full support for HTML5.
- **Trident** - The Trident engine is used by different versions of Internet Explorer (IE). Currently, HTML5 is not majorly supported by the Trident engine. IE9 was anticipated to support HTML5 completely, but it has failed to support some features such as the advanced form element support and geolocation.
- **WebKit** - The WebKit engines is supported mainly for the Safari browser used in Apple Macs, iPhones, iPads, and other Apple products. This engine is based on the open source KHTML project. Webkit is also the base for Android based browsers such as Google Chrome.

WebKit has evolved to become the standard rendering engine for mobile platforms. WebKit has the maximum support for most of the HTML5 elements, although it still does not support everything.

- **Presto** - Presto is the engine used in the Opera browsers. Opera browsers are considered to be a technically superior browser, but market share of Opera browsers is still low.

Each browser interprets the Website code in a different manner, which means that it can appear differently to users using different browsers.

Best practices for optimum browser compatibility are as follows:

- **Test the Website in different browsers** - Once the Website design is created, review the Website's appearance and functionality on multiple browsers to ensure that all the users are getting the same experience according to the design. Preferably test on different versions of the same browser also as they can show the Website differently.
- **Write a good clean HTML coding** - Sometimes the Website may appear correctly in some browsers even if the HTML code is not valid, but there is no guarantee that it will appear correctly in all the browsers. To ensure that the page looks same in all browsers is to write Web pages using valid HTML and CSS codes, and then, test it in many browsers. Using External CSS can help pages render and load faster.

5.8 Check Your Progress

1. It is common for two images with the same number of _____ and _____ to have a very different compressed file size.

(A)	pixels, color depth	(C)	size, container
(B)	height, width	(D)	content, size

2. Which of the following browsers support CSS3 Transitions?

(A)	Apple Safari 2.1	(C)	Opera 10.5x
(B)	Google Chrome	(D)	IE 4

3. The CSS padding properties define the _____ between the element border and the element content.

(A)	size	(C)	distance
(B)	space	(D)	font

4. Match the features against the usability.

Value		Description	
(A)	auto	1.	Specifies that the value of the height property should be inherited from the parent element
(B)	length	2.	Defines the height in percent of the containing block
(C)	%	3.	Defines the height in px, cm, and so on
(D)	inherit	4.	The browser calculates the height. This is default

(A)	a-2, b-1, c-3, d-4	(C)	a-4, b-1, c-2, d-3
(B)	a-1, b-2, c-3, d-4	(D)	a-4, b-3, c-2, d-1

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5. Which of the following is the engine for Safari browser?

(A)	Presto	(C)	Trident
(B)	WebKit	(D)	Gecko

6. Which of the following statements are valid for performing CSS transitions?

(A)	Specify the name for transition
(B)	Specify the CSS property, that has to add an effect
(C)	Specify the duration of the effect
(D)	Specify the language to be used

5.8.1 Answers

1.	A
2.	B, C
3.	B
4.	D
5.	B
6.	B, C

Summary

- The text styles specify and control the appearance of the text in a Web page.
- Indenting is the process of offsetting text from its normal position, either to the left or to the right.
- CSS border property specifies the style, color, and width of the border.
- The border-color property accepts different color values that determine different shades of color to be applied to the borders.
- Values of different border properties determine the type of effect to be applied to the borders.
- In CSS, the text-align property is used for horizontal alignment of text in an element.
- In CSS, the line-height property is used for vertical alignment of text in an element.

Try It Yourself

1. Alex wants to write an article on his Web page related to their products. For writing major quotes of the article he wants to provide suitable width with white background. Also, he wants headings and images in an article should be center aligned. Use CSS code to create this Web page.



Session - 6

Understanding Layouts in CSS3

Welcome to the Session, **Understanding Layouts in CSS3**.

This session introduces the flexbox and the grid layout modules and their corresponding elements.

In this Session, you will learn to:

- ➔ Describe flexbox and grid layouts
- ➔ Describe different flexbox properties
- ➔ Explain different grid properties

6.1 Introduction

Layouts in modern CSS are an important introduction for Web designers as they effectively assist in achieving complicated designs. Layouts prove to be a game changer for designers, eliminating older styles of designing and replacing them with simpler, easier, and efficient methods.

Flexbox and Grid are two popular layouts that are used in the modern CSS. They are defined as follows:

- Flexbox provides one-dimensional layout. It defines layout either for a row or a column.
- Grid provides two-dimensional layout. It defines layout to both row and column, simultaneously.

Figure 6.1 shows the use of flexbox and grid.

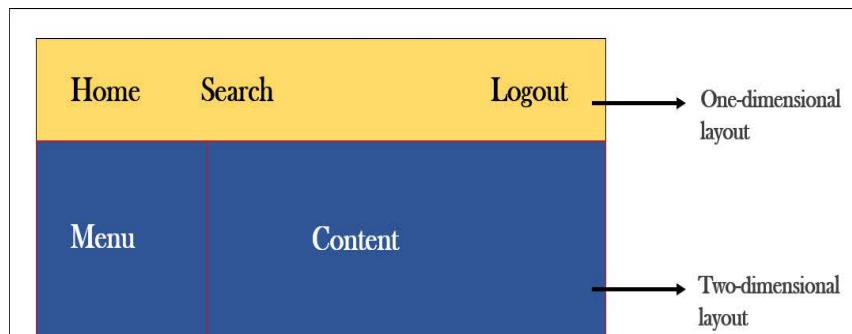


Figure 6.1: Use of Flexbox and Grid – An Example

6.2 CSS Flexbox Layout Module

The CSS Flexible Box Layout Module, also known as Flexbox, is a convenient way to organize items. It takes care of the alignment, layout, and space distribution. It is a perfect tool to place components on Web pages, such as galleries and menu bars.

Figure 6.2 shows the basic skeleton of a flexbox.

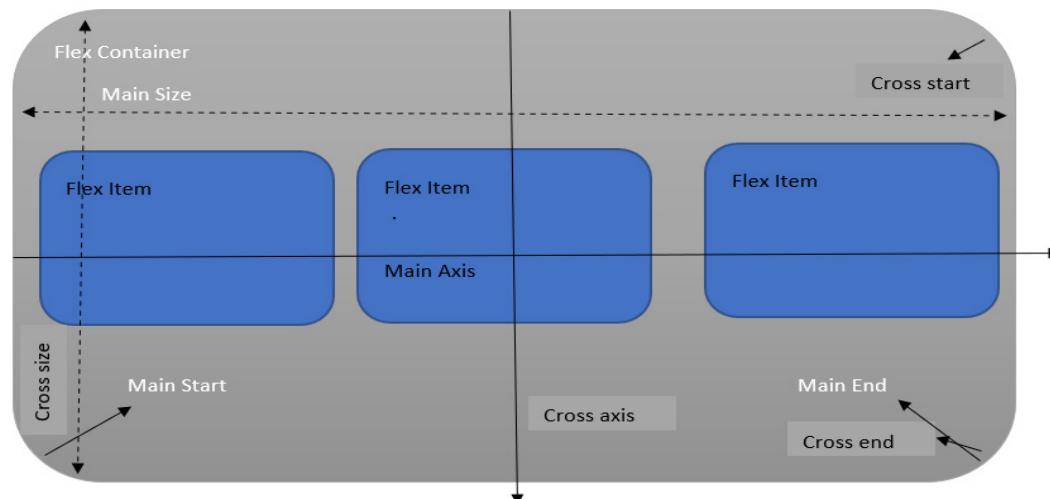


Figure 6.2: Basic Skeleton of a Flexbox

Table 6.1 explains each component of a flexbox.

Flex Component	Description
Flex Container	It is the basic element of the module.
Flex Item	All items in a flex container are referred to as flex items. A flex container is a parent element and flex items are its children.
Main Axis	The direction of flex items makes the main axis. The flex items can be stacked vertically from top to bottom or bottom to top. They can also be arranged horizontally either from left to right or right to left. This is the primary axis.
Main Start and Main End	This represents the start and end points for flex items in the flex container.
Main Size	This is the width or height of a flex item.
Cross Axis	This is the secondary axis and is always perpendicular to the main axis. If the main axis is horizontal, the cross axis is vertical, and vice-versa. Cross axis helps in aligning the flex items.
Cross-Start and Cross-End	The start point of cross axis is cross-start. The end point of cross axis is cross-end.
Cross Size	This is the width or height of a flex item in the cross dimension.

Table 6.1: Components of Flexbox

6.2.1 Properties of Flexbox Container

A container is the parent element. Child elements of this container are flex items. The layout of the flex items can be controlled by the container properties. Following describes each property:

- **display:** This defines the type of flexbox of the parent container. All the child elements in it are called the ‘flex items’. This means flexibility, such as growth and spacing between the elements can be controlled. In a flexible layout, the display property is set to flex.

Code Snippet 1 shows the display property of the flex container set to flex.

Code Snippet 1:

```
.flex-container {
    display: flex;
}
```

- **flex-direction:** This defines how the flex items should be stacked, whether horizontally or vertically. Vertically (column), the flex items can be stacked from top to bottom or bottom to top. Horizontally (row), the flex items can be stacked from left to right or right to left.

Following is the syntax:

```
flex-direction: row | row-reverse | column | column-reverse;
```

Code Snippet 2 shows the use of flex direction column to stack the flex items vertically.

Code Snippet 2:

```
<head>
<style>
.flex-container {
  display: flex;
  flex-direction: column;
  background-color: Yellow;
}
.flex-container > div {
  background-color: lightblue;
  width: 85px;
  margin: 10px;
  text-align: center;
  line-height: 75px;
  font-size: 30px;
}
</style>
</head>
<body>
<div class="flex-container">
  <div>A</div>
  <div>B</div>
  <div>C</div>
</div>
</body>
</html>
```

Figure 6.3 shows the output for Code Snippet 2.



Figure 6.3: Example of Flex Direction - column

Note that the yellow area is the flex container that has three flex items.

- **flex-wrap:** This specifies that flex items will wrap if required. Following is the syntax:

```
flex-wrap: nowrap | wrap | wrap-reverse;
```

In the syntax,

- nowrap (default) keeps all flex items on one line.
- wrap wraps flex items on multiple lines, from top to bottom.
- wrap-reverse wraps flex items on multiple lines from bottom to top.

Code Snippet 3 shows the flex-wrap property set to wrap-reverse.

Code Snippet 3:

```
<!DOCTYPE html>
<html>
<head>
<style>
.flex-container {
  display: flex;
  flex-wrap: wrap-reverse;
  background-color: Yellow;
}
.flex-container > div {
  background-color: lightblue;
  width: 85px;
  margin: 10px;
  text-align: center;
  line-height: 75px;
  font-size: 30px;
}
</style>
</head>
<body>
<div class="flex-container">
  <div>A</div>
  <div>B</div>
  <div>C</div>
  <div>D</div>
  <div>E</div>
  <div>F</div>
</div>

```

```
<div>G</div>
<div>H</div>
<div>I</div>
<div>J</div>
<div>K</div>
</div>
</body>
</html>
```

Figure 6.4 shows the output for Code Snippet 3.

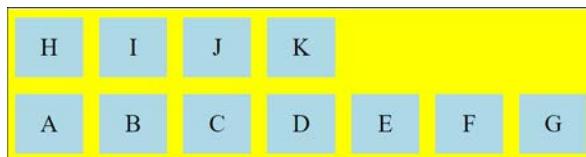


Figure 6.4: flex-wrap Property: wrap-reverse

- **flex-flow:** Using this property, both flex-direction and flex-wrap properties can be set together. Following is the syntax:

```
flex-flow: column wrap | row wrap;
```

Code Snippet 4 shows the flex-flow property set to row wrap.

Code Snippet 4:

```
<!DOCTYPE html>
<html>
<head>
<style>
.flex-container {
  display: flex;
  flex-flow: row wrap;
  background-color: yellow;
}
.flex-container > div {
  background-color: lightblue;
  width: 85px;
  margin: 10px;
  text-align: center;
  line-height: 75px;
}
```

```
font-size: 30px;  
}  
</style>  
</head>  
<body>  
<div class="flex-container">  
    <div>A</div>  
    <div>B</div>  
    <div>C</div>  
    <div>D</div>  
    <div>E</div>  
    <div>F</div>  
    <div>G</div>  
    <div>H</div>  
    <div>I</div>  
    <div>J</div>  
    <div>K</div>  
</div>  
</body>  
</html>
```

Figure 6.5 shows the output for Code Snippet 4.

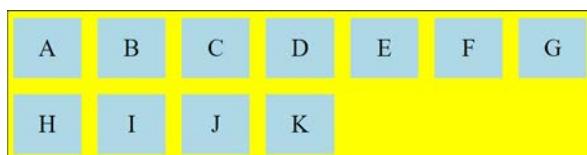


Figure 6.5: flex-flow Property: row wrap

- **justify-content:** This defines the alignment of flex items. The flex items can be aligned at the center, beginning, or end of the container. Spacing can also be adjusted after, before, or between the flex lines. Flex line refers to the direction of the text. Following is the syntax:

```
justify-content: flex-start | flex-end | center | space-between | space-around | space-evenly;
```

In the syntax,

- **flex-start** aligns flex items at the beginning of the container.
- **flex-end** aligns flex items at the end of the container.
- **center** aligns flex items at the center of the container.
- **space-between** displays flex items with space between the lines.
- **space-around** displays the flex items in even distribution on the line with equal space

around them.

- space-evenly distributes the flex items with equal spacing between the items. The space to the edges is also equal.

Code Snippet 5 uses the `flex-end` attribute of `justify-content` property.

Code Snippet 5:

```
<!DOCTYPE html>
<html>
<head>
<style>
.flex-container {
  display: flex;
  justify-content: flex-end;
  background-color: yellow;
}
.flex-container > div {
  background-color: lightblue;
  width: 85px;
  margin: 10px;
  text-align: center;
  line-height: 75px;
  font-size: 30px;
}
</style>
</head>
<body>
<div class="flex-container">
  <div>A</div>
  <div>B</div>
  <div>C</div>
</div>
</body>
</html>
```

Figure 6.6 shows the output for Code Snippet 5.



Figure 6.6: flex-end Attribute Of `justify-content` Property

Figure 6.7 shows an output using the `space-around` property.

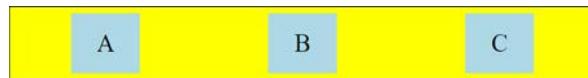


Figure 6.7: space-around Attribute Of justify-content Property

- **align-items:** Using this property, the flex items can be aligned in the middle, top, or bottom of the container. The flex items can also be stretched to fill the container. Following is the syntax:

```
align-items: stretch | flex-start | flex-end | center | baseline;
```

In the syntax,

- `stretch` stretches the flex items to fill the container.
- `flex-start` aligns the flex items at the top of the container.
- `flex-end` aligns the flex items at the bottom of the container.
- `center` aligns the flex items in the middle of the container.
- `baseline` aligns the flex items to their baselines.

Code Snippet 6 uses the `stretch` attribute of `align-items` property.

Code Snippet 6:

```
<!DOCTYPE html>
<html>
<head>
<style>
.flex-container {
  display: flex;
  height: 200px;
  align-items: stretch;
  background-color: yellow;
}
.flex-container > div {
  background-color: lightblue;
  width: 85px;
  margin: 10px;
  text-align: center;
  line-height: 75px;
}
```

```
font-size: 30px;  
}  
</style>  
</head>  
<body>  
<div class="flex-container">  
    <div>A</div>  
    <div>B</div>  
    <div>C</div>  
</div>  
</body>  
</html>
```

Figure 6.8 shows the output for Code Snippet 6.

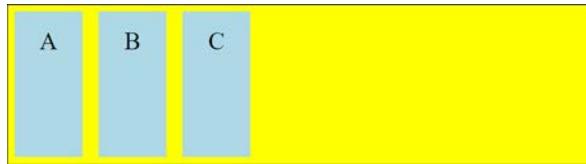


Figure 6.8: stretch Attribute of align-items Property

Figure 6.9 shows an output using the baseline property.

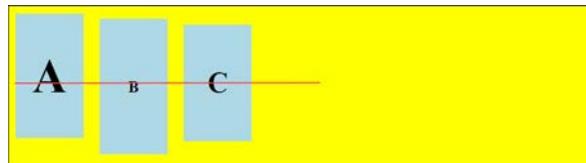


Figure 6.9: baseline Attribute of align-items Property

- **align-content:** This aligns the flex lines. Spacing can also be adjusted before, between, or after the flex lines. Following is the syntax:

```
align-content: flex-start | flex-end | center | space-between | space-around | stretch | start | end;
```

In the syntax:

- **flex-start** displays flex lines at the start of the container.
- **flex-end** displays flex lines at the end of the container.
- **center** displays flex lines in the middle of the container.
- **stretch** stretches flex lines to take the remaining space.
- **space-around** displays flex lines with space before, after, and between them.
- **space-between** displays flex lines with equal space between them.

Code Snippet 7 uses the `flex-start` property.

Code Snippet 7:

```
<!DOCTYPE html>
<html>
<head>
<style>
.flex-container {
  display: flex;
  height: 500px;
  flex-wrap: wrap;
  align-content: flex-start;
  background-color: yellow;
}
.flex-container > div {
  background-color: lightblue;
  width: 85px;
  margin: 10px;
  text-align: center;
  line-height: 75px;
  font-size: 30px;
}
</style>
</head>
<body>
<div class="flex-container">
  <div>A</div>
  <div>B</div>
  <div>C</div>
  <div>D</div>
  <div>E</div>
  <div>F</div>
  <div>G</div>
  <div>H</div>
  <div>I</div>
  <div>J</div>
  <div>K</div>
  <div>L</div>
</div>
</body>
</html>
```

Figure 6.10 shows the output for Code Snippet 7.

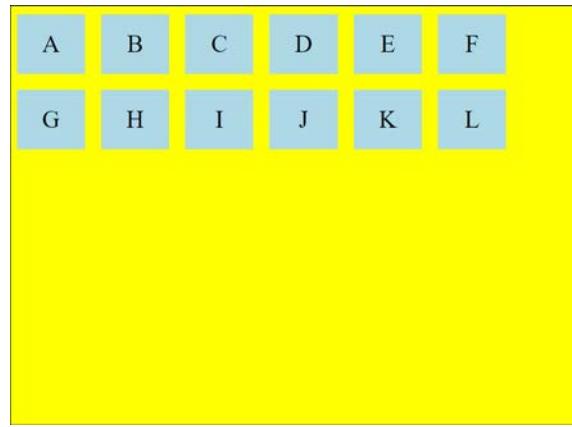


Figure 6.10: flex-start Attribute of align-content Property

Figure 6.11 shows an output using the space-around property.

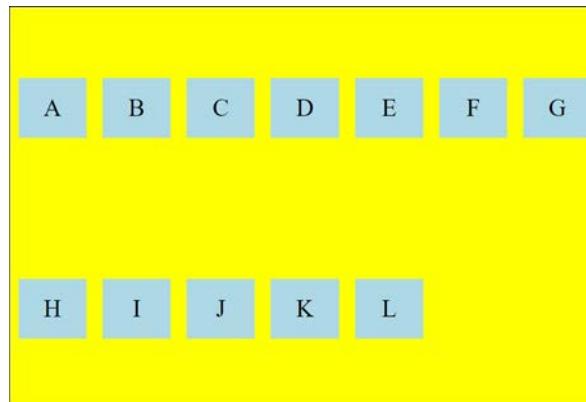


Figure 6.11: space-around Attribute of align-content Property

6.2.2 Properties of Flex Item

Consider that some flex items have to be rearranged or a particular flex item requires to be shrunk. Such changes can be done using the properties of a flex item. Following explains each flex item property:

- ➔ **order** defines the order of the flex items. The value assigned to it should be a number. Code Snippet 8 displays the use of the order property.

Code Snippet 8:

```
<style>
.flex-container {
  display: flex;
  align-items: stretch;
  background-color: yellow;
}
```

```
.flex-container>div {  
    background-color: lightblue;  
    color: black;  
    width: 85px;  
    margin: 10px;  
    text-align: center;  
    line-height: 75px;  
    font-size: 30px;  
}  
</style>  
</head>  
<body>  
<div class="flex-container">  
    <div style="order: 3">A</div>  
    <div style="order: 2">B</div>  
    <div style="order: 4">C</div>  
    <div style="order: 1">D</div>  
</div>  
</body>  
</html>
```

Figure 6.12 shows the output for Code Snippet 8.



Figure 6.12: order Property

- **flex-grow** helps grow a flex item relative to the rest of the flex items. The value assigned to it should be a number. In Code Snippet 9, second flex item grows six times and third flex item grows twice.

Code Snippet 9:

```
<!DOCTYPE html>  
<html>  
<head>  
<style>  
.flex-container {  
    display: flex;  
    align-items: stretch;  
    background-color: yellow;
```

```
}

.flex-container > div {
    background-color: lightblue;
    color: black;
    margin: 10px;
    text-align: center;
    line-height: 75px;
    font-size: 30px;
}

</style>
</head>
<body>
<div class="flex-container">
    <div style="flex-grow: 1">A</div>
    <div style="flex-grow: 6">B</div>
    <div style="flex-grow: 2">C</div>
</div>
</body>
</html>
```

Figure 6.13 shows the output for Code Snippet 9.

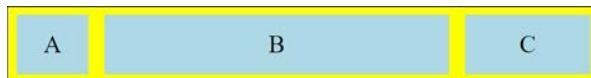


Figure 6.13: flex-grow Property

- **flex-shrink** helps shrink a flex item relative to the rest of the flex items. This property takes a number value. In Code Snippet 10, it is specified not to shrink the second and third flex items.

Code Snippet 10:

```
<!DOCTYPE html>
<html>
<head>
<style>
.flex-container {
    display: flex;
    align-items: stretch;
    background-color: yellow;
}
.flex-container>div {
```

```
background-color: lightblue;
color: black;
width: 100px;
margin: 10px;
text-align: center;
line-height: 75px;
font-size: 30px;
}
</style>
</head>
<body>
<div class="flex-container">
<div>A</div>
<div>B</div>
<div style="flex-shrink: 0">C</div>
<div style="flex-shrink: 0">D</div>
<div>E</div>
<div>F</div>
<div>G</div>
<div>H</div>
<div>I</div>
</div>
</body>
</html>
```

Figure 6.14 shows the output for Code Snippet 10.



Figure 6.14: flex-shrink Property

- **flex-basis** defines initial length of a flex item.
- **flex** allows to specify **flex-grow**, **flex-shrink**, and **flex-basis** properties altogether.
- **align-self** defines alignment for a flex item. The **align-self** property overrides the **align-items** property of the container.

Table 6.2 shows different outputs if the `flex-container` class of Code Snippet 10 uses `flex-basis`, `flex`, and `align-self` properties.

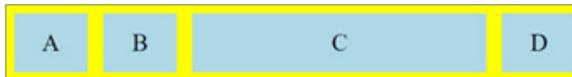
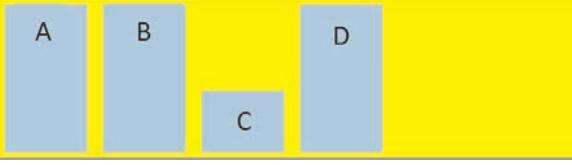
Property	Code Snippet	Output
<code>flex-basis</code>	<pre><div class="flex-container"> <div>A</div> <div>B</div> <div style="flex-basis:400px">C</div> <div>D</div> </div> <!--Here, the length of the third flex item is set to 400.--&gt;</pre> </pre>	
<code>flex</code>	<pre><div class="flex-container"> <div>A</div> <div style="flex: 0 0 200px">B</div> <div>C</div> <div>D</div> </div> <!--Here, the length of the second flex item is set to 200. The grow and shrink values are set to 0. It is neither growable nor shrinkable.--&gt;</pre> </pre>	
<code>align-self</code>	<pre><div class="flex-container"> <div>A</div> <div>B</div> <div style="align-self: flex-end">C</div> <div>D</div> </div> <!--Here, the third flex item is aligned to the bottom of the container. The height of the container should be specified for .flex-container. It can be set to any range such as 200px.--&gt;</pre> </pre>	

Table 6.2: `flex-basis`, `flex`, and `align-self` Properties

6.3 CSS Grid Layout Module

It is easier to design Web pages using a grid layout. A grid layout has one parent element with one or more child elements. Items in a grid container are called grid items. All grid items are placed inside columns and rows.

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Figure 6.15 shows an example of a grid layout.

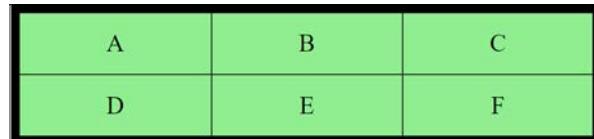


Figure 6.15: Grid Layout

Figure 6.15 has one grid container with six grid items.

Table 6.3 describes certain terminologies associated with the CSS grid layout.

Term	Description
Grid Container	It holds elements of a grid such as row, column, and cell.
Grid Item	Child elements of a grid container are called grid items. A grid container is the parent of all grid items.
Grid Line	Grid lines make the structure of the grid. These are the dividing lines. Vertical grid line refers to column grid line and horizontal grid line refers to row grid line.
Grid Cell	It is the single unit of a grid. It is bound by two row grid lines and two column grid lines.
Grid Track	It is a generic term for a grid column or row.
Grid Area	It is the area that includes grid cells.
Grid Gap	It refers to the gap between rows and columns.
Grid Column	It is the space between two adjacent vertical grid lines is a grid column.
Grid Row	It is the space between two adjacent horizontal grid lines is a grid row.

Table 6.3: Important Terminologies of CSS Grid Layout

Figure 6.16 displays certain components of a grid.

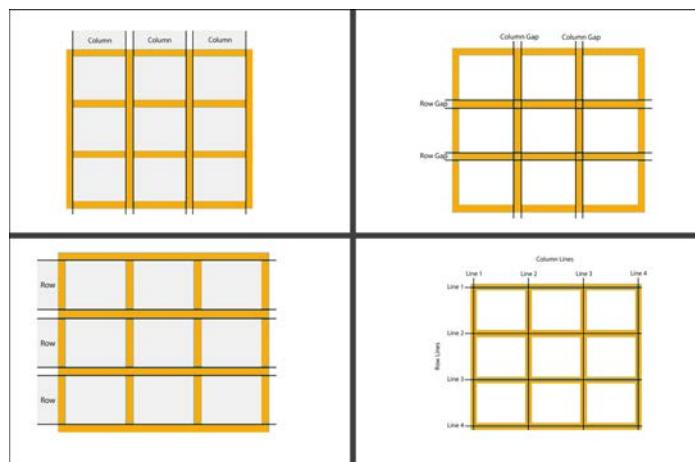


Figure 6.16: Certain Components of Grid

To convert an HTML element into a grid container, set the display property to grid or inline-grid. Code Snippet 11 shows how to set the display property to grid.

Code Snippet 11:

```
.grid-container {  
    display: grid;  
}
```

Earlier Figure 6.15 shows a grid. Grid makes a block-level grid container. Code Snippet 12 shows how to set the display property to inline-grid to generate an inline-level grid.

Code Snippet 12:

```
.grid-container {  
    display: inline-grid;  
}
```

Figure 6.17 shows an inline grid.

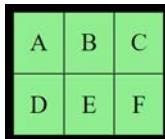


Figure 6.17: Inline Grid

6.3.1 Grid Container Properties

Using the grid container properties, layout of the grid can be controlled. For example, number of columns or rows and height of rows can be specified, and grid can be aligned inside the container. Following explains certain important properties of a grid container:

- **grid-template-columns** defines number and size of columns. Following is the syntax of the property:
`grid-template-columns: <column_width> <column_width> <auto>... . . .;`
auto indicates all columns should have same width.
- **grid-template-rows** defines height of rows. Following is the syntax of the property:
`grid-template-rows: <row_height> <row_height>... . . .;`
- **grid-column-gap** defines size of the gap between columns. Following is the syntax of the property:
`grid-column-gap: <line-size>;`

- **grid-row-gap** defines size of the gap between rows. Following is the syntax of the property:

```
grid-row-gap: <line-size>;
```

- **grid-gap** allows to use both grid-row-gap and grid-column-gap properties together. Following is the syntax of the property:

```
grid-gap: <grid-row-gap> <grid-column-gap>;
```

- **justify-content** helps align grid items along the inline row axis. Following is the syntax of the property:

```
justify-content: space-evenly | space-around | space-between | center | start | end;
```

In the syntax:

- `space-evenly` gives columns equal amount of space between and around them.
- `space-around` gives columns equal amount of space around them.
- `space-between` gives columns equal amount of space between them.
- `center` aligns the grid in the middle of the container.
- `start` aligns the grid at the beginning of the container.
- `end` aligns the grid at the end of the container.

- **align-content** helps vertically align whole grid along the block column axis. Following is the syntax of the property:

```
align-content: space-evenly | space-around | space-between | center | start | end;
```

In the syntax:

- `space-evenly` gives rows equal amount of space between and around them.
- `space-around` gives rows equal amount of space around them.
- `space-between` gives rows equal amount of space between them.
- `center` aligns rows in the middle of the container.
- `start` aligns rows at the beginning of the container.
- `end` aligns rows at the end of the container.

Code Snippet 13 shows the use of `justify-content`, `grid-template-columns`, and `grid-gap` properties.

Code Snippet 13:

```
<!DOCTYPE html>
<html>
<head>
<style>
.grid-container {
  display: grid;
```

```
justify-content: end;
grid-template-columns: 60px 60px auto;
grid-gap: 10px;
background-color: lightgreen;
padding: 10px;
}
.grid-container > div {
background-color: lightblue;
text-align: center;
padding: 20px 0;
font-size: 30px;
}
</style>
</head>
<body>
<div class="grid-container">
<div>A</div>
<div>B</div>
<div>C</div>
<div>D</div>
<div>E</div>
<div>F</div>
</div>
</body>
</html>
```

Figure 6.18 shows the output for Code Snippet 13.



Figure 6.18: justify-content, grid-template-columns, and grid-gap Properties

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Code Snippet 14 shows the use of align-content property.

Code Snippet 14:

```
<!DOCTYPE html>
<html>
<head>
<style>
.grid-container {
  display: grid;
  height: 300px;
  align-content: space-between;
  grid-template-columns: auto auto auto;
  grid-gap: 10px;
background-color: lightgreen;
  padding: 10px;
}
.grid-container > div {
  background-color: lightblue;
  text-align: center;
  padding: 20px 0;
  font-size: 30px;
}
</style>
</head>
<body>
<div class="grid-container">
  <div>A</div>
  <div>B</div>
  <div>C</div>
  <div>D</div>
  <div>E</div>
  <div>F</div>
</div>
</body>
</html>
```

Figure 6.19 shows the output for Code Snippet 14.

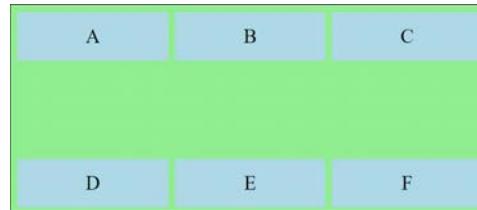


Figure 6.19: align-content Property

6.3.2 Adjusting Gap Size

Code Snippet 15 shows how to adjust the gap size using the grid-gap property.

Code Snippet 15:

```
<!DOCTYPE html>
<html>
<head>
<style>
.grid-container {
  display: grid;
  grid-gap: 30px 60px;
  grid-template-columns: auto auto auto;
  background-color: lightgreen;
  padding: 10px;
}
.grid-item {
  background-color: lightblue;
  border: 1px solid rgba(0, 0, 0, 0.8);
  padding: 20px;
  font-size: 30px;
  text-align: center;
}
</style>
</head>
<body>
<div class="grid-container">
  <div class="grid-item">A</div>
  <div class="grid-item">B</div>
  <div class="grid-item">C</div>
  <div class="grid-item">D</div>
  <div class="grid-item">E</div>
  <div class="grid-item">F</div>
  <div class="grid-item">G</div>
  <div class="grid-item">H</div>
  <div class="grid-item">I</div>
</div>
</body>
</html>
```

Figure 6.20 shows the output for Code Snippet 15.

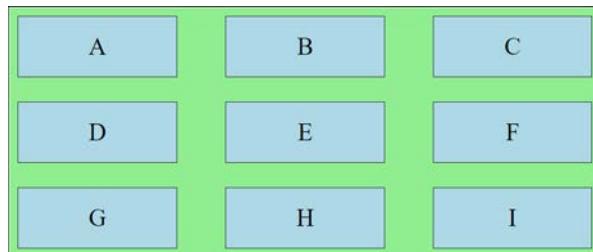


Figure 6.20: grid-gap Property

6.3.3 Grid Items

Using the grid item properties, grid items can be styled. Following explains each property:

- **grid-column** specifies column(s) to place an item. It helps specify where the item will start and end.

Following is the syntax of the property:

```
grid-column: Start_of_Column_Number / End_of_column_number | Start_of_Column_Number / span_number_of_columns;
```

Code Snippet 16 shows an example of using the grid-column property.

Code Snippet 16:

```
<!DOCTYPE html>
<html>
<head>
<style>
.grid-container {
  display: grid;
  grid-template-columns: auto auto auto auto auto auto;
  grid-gap: 10px;
  background-color: lightgreen;
  padding: 10px;
}
.grid-container > div {
  background-color: lightblue;
  text-align: center;
  padding: 20px 0;
  font-size: 30px;
}
.item2 {
  grid-column: 2 / span 5;
```

```
}

</style>

</head>

<body>

<div class="grid-container">
    <div class="item1">A</div>
    <div class="item2">B</div>
    <div class="item3">C</div>
    <div class="item4">D</div>
    <div class="item5">E</div>
    <div class="item6">F</div>
    <div class="item7">G</div>
    <div class="item8">H</div>
    <div class="item9">I</div>
    <div class="item10">J</div>
    <div class="item11">K</div>
    <div class="item12">L</div>
</div>
</body>
</html>
```

Figure 6.21 shows the output for Code Snippet 16.

A	B					
C	D	E	F	G	H	
I	J	K	L			

Figure 6.21: grid-column Property

- **grid-row** specifies the row to place an item. It helps specify where the item will start and end. Following is the syntax of the property:

```
grid-row: Start_of_Row_Number / End_of_Row_number | Start_of_Row_Number / Span_Number_of_Rolumns;
```

Code Snippet 17 shows an example of using the **grid-row** property.

Code Snippet 17:

```
<!DOCTYPE html>
<html>
<head>
```

```
<style>
.grid-container {
  display: grid;
  grid-template-columns: auto auto auto auto auto auto;
  grid-gap: 10px;
  background-color: lightgreen;
  padding: 10px;
}
.grid-container > div {
  background-color: lightblue;
  text-align: center;
  padding: 20px 0;
  font-size: 30px;
}
.item1 {
  grid-row: 1 / span 2;
}
</style>
</head>
<body>
<div class="grid-container">
  <div class="item1">A</div>
  <div class="item2">B</div>
  <div class="item3">C</div>
  <div class="item4">D</div>
  <div class="item5">E</div>
  <div class="item6">F</div>
  <div class="item7">G</div>
  <div class="item8">H</div>
  <div class="item9">I</div>
  <div class="item10">J</div>
  <div class="item11">K</div>
  <div class="item12">L</div>
</div>
</body>
</html>
```

Figure 6.22 shows the output for Code Snippet 17.

A	B	C	D	E	F
	G	H	I	J	K
L					

Figure 6.22: grid-row Property

- **grid-area** helps use **grid-row-start**, **grid-column-start**, **grid-row-end**, and **grid-column-end** properties together. The properties helps specify where to start and end the grid item with respect to column and row. The **grid-area** property can also be used to assign names to grid items for a Web page template using following syntax:

```
grid-area: <Web page element name>;
```

Code Snippet 18 shows an example of assigning names to grid items for a Web page template.

Code Snippet 18:

```
<!DOCTYPE html>
<html>
<head>
<style>
.item1 { grid-area: header; }
.item2 { grid-area: menu; }
.item3 { grid-area: main; }
.item4 { grid-area: footer; }
.grid-container {
  display: grid;
  grid-template-areas:
    'header header header header header header'
    'menu main main main main'
    'menu footer footer footer footer footer';
  grid-gap: 10px;
  background-color: lightgreen;
  padding: 10px;
}
.grid-container > div {
  background-color: lightblue;
  text-align: center;
  padding: 20px 0;
  font-size: 30px;
```

```
}

</style>
</head>
<body>
<div class="grid-container">
  <div class="item1">Header</div>
  <div class="item2">Menu</div>
  <div class="item3">Main</div>
  <div class="item4">Footer</div>
</div>
</body>
</html>
```

Figure 6.23 shows the output for Code Snippet 18.

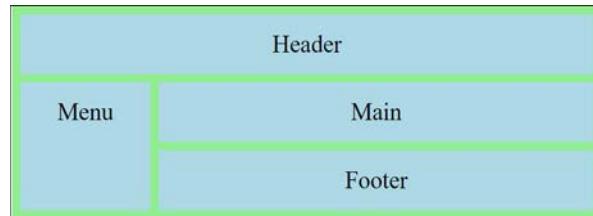


Figure 6.23: grid-area Property

6.4 Check Your Progress

1. Identify all the components of a flexbox.

(A)	main axis	(C)	main size
(B)	grid	(D)	cross size

2. Which property defines the type of flexbox?

(A)	flex	(C)	wrap
(B)	show	(D)	display

3. Which of the following options describe justify-content property?

(A)	Aligns the flex items at the center of the container	(C)	Keeps all flex items on one line
(B)	Allows to use both flex-direction and flex-wrap properties together((D)	Aligns the flex items at the end of the container

4. What is a grid gap?

(A)	Area that includes grid cells	(C)	Space between two adjacent vertical grid lines is a grid column
(B)	Gap between rows and columns	(D)	Single unit of a grid

5. Which of the following statements are true?

(A)	Grid lines make the structure of the grid.	(C)	Grid cell is a generic term for a grid column or row.
(B)	Child elements of a grid container are called grid items.	(D)	Grid area is the single unit of a grid.

6.4.1 Answers

1.	A, C, D
2.	D
3.	A, D
4.	B
5.	A, B, C

Summary

- ➔ Flexbox provides one-dimensional layout.
- ➔ Grid provides two-dimensional layout.
- ➔ A container is the parent element and child elements of the container are flex items.
- ➔ A grid layout has one parent element with one or more child elements.
- ➔ Items in a grid container are called grid items.
- ➔ All grid items are placed inside columns and rows.
- ➔ Layout of grid, flexbox, flex items, and grid items can be controlled using different properties.

Try It Yourself

1. Mathew wants to develop a Website on different online games available in the market. Design three Web page templates using different flexbox properties and the grid area property.



Session - 7

New Features of CSS3

Welcome to the Session, **New Features of CSS3**.

This session introduces the CSS Subgrid, Flexbox Gap, and other new features in CSS3.

In this Session, you will learn to:

- ➔ Explain subgrid layout
- ➔ Illustrate new viewport units with examples
- ➔ Explain nesting

7.1 CSS Subgrid

CSS subgrid is a new feature introduced in CSS Grid Layout Module Level 2. It is a powerful UI tool with the ability to produce outstanding layouts. Without subgrid, nested grids can lead to erratic placement of items when the grid is stretched or resized. This is because all the grids have different sized contents that influence the layout that makes each element act independently. Moreover, nested grids lacked support for responsive Web design. In today's digital world with variety of screen sizes, support for a responsive Web page is imperative. For this reason, subgrids were introduced in CSS.

The subgrid feature in CSS entails child grid containers that aligns with the parent grid. As the subgrid feature allows child grid to inherit the grid structure of the parent container, it simplifies creation of intricate layouts. The developer does not have to design the grid template or grid lines for the child grid container. This is automatically inherited from the parent grid container.

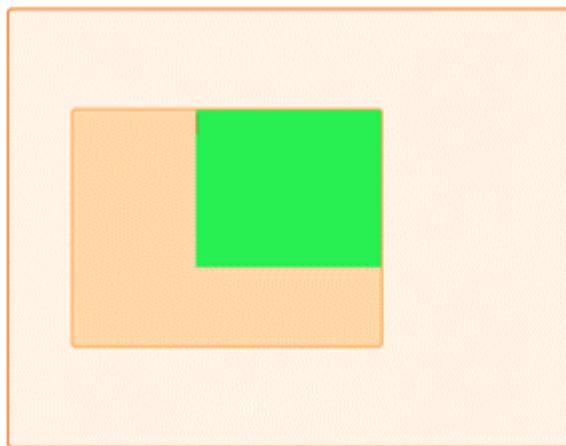


Figure 7.1: Subgrid

As can be seen in Figure 7.1, one grid is placed within another grid to make child grid part of parent grid container.

To apply subgrid to a project, it must be activated in the nested grid container by specifying the `subgrid` value for the `grid-template-columns` or `grid-template-rows` property. The child grid container now applies the grid tracks of the parent grid container to establish its own grid. This enables the creation of nested grids with consistent track alignment, making it easier to design flexible and complex layouts. Code Snippet 1 illustrates an example for applying the CSS subgrid.

Code Snippet 1:

```
parent {  
    display: grid;  
    grid-template-columns: 1fr 1fr;  
    grid-template-rows: 100px 100px;  
    gap: 10px;  
}
```

```
}

.child {
  display: grid;
  grid-template-columns: subgrid;
  gap: 10px;
}
```

In Code Snippet 1, the child grid container utilizes the subgrid value for grid-template-columns property. This enables it to inherit the grid columns of the parent grid container. The child grid items can now align with the tracks of the parent grid container.

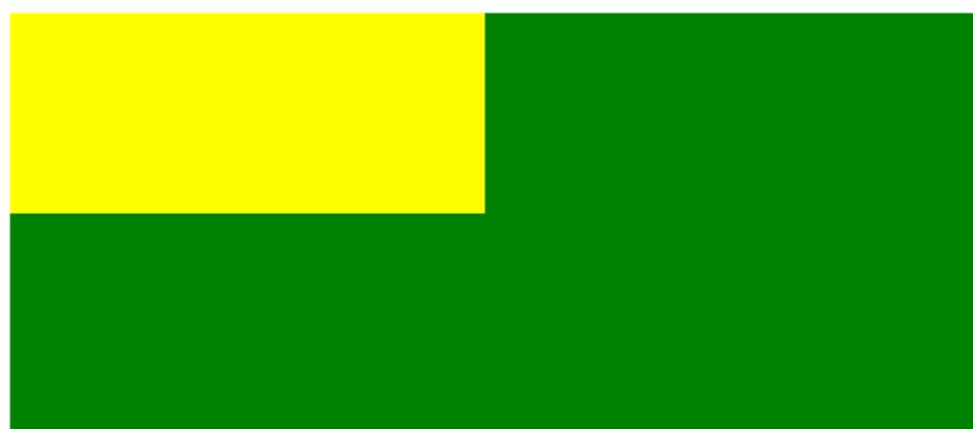


Figure 7.2: Subgrid Output

As can be seen in Figure 7.2, the child grid objects can line up with the parent grid container's tracks. Overall, CSS subgrid is an extension of CSS Layout that helps design a complex layout. As of March 2023, CSS subgrid is supported by some modern browsers such as Firefox and Safari, although not all versions of these browsers are supported.

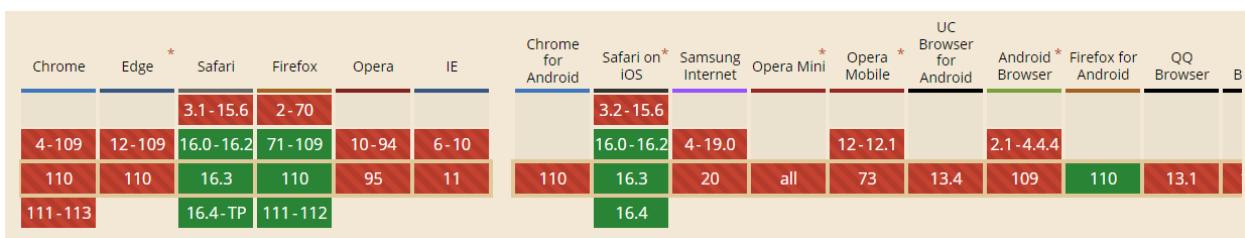


Figure 7.3: Browser Compatibility of Subgrid Feature

The browser compatibility for subgrid as obtained from <https://caniuse.com> is illustrated in Figure 7.3. The green blocks indicate the browsers that support CSS subgrid and red blocks indicate the browsers that do not support CSS subgrid. It is, therefore, recommended to check the compatibility of the browser before implementing this feature.

7.2 Flexbox Gap

Flexbox Gap property of CSS is a new feature introduced in 2021 as a part of CSS Box Alignment Module Level 3. This feature helps add space between child items of a container. This is achieved without having to add any extra padding or margins to the item itself. When the `gap` property of Flexbox layout is applied, it works by adding space between the flex items along both the main axis (the primary axis along which flex items are laid out) and the cross axis (the perpendicular axis) as shown in Figure 7.4.



Figure 7.4: Flexbox Axes

Figure 7.5 illustrates the components of Flexbox, container, and items.

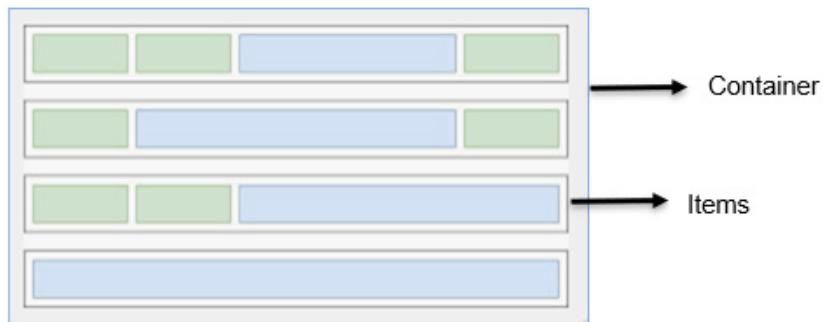


Figure 7.5: Flexbox

To add the gap between the items, the `gap` property has to be set. It takes one or two values that represent the size of the gap between items along the main axis and cross axis respectively. This is illustrated with an example as shown in Code Snippet 2.

Code Snippet 2:

```
.container {  
    display: flex;  
    gap: 20px;  
}
```

As shown in Code Snippet 2, the `gap` property is set to 20px. This indicates that there is a gap of 20px between each flex item along both the main axis and the cross axis.

The `gap` property of flexbox is an excellent way to add consistent spacing between flex items within a container. While creating a responsive or dynamic layout, there is a constant variation in the content size and structure. The `gap` property allows the spacing to be adjusted automatically as the container size changes. The amount of code required is considerably reduced as extra CSS coding is not required to achieve the desired result. This also improves the performance of the Website as the amount of code to be processed reduces considerably.

Overall, Flexbox `gap` property is an excellent feature that is an efficient tool to create responsive Website layouts with lesser processing time and a more consistent layout design.

7.3 Cascade Layer

In CSS, the cascade layers determine how CSS rules are applied to an HTML page during a Web page development. When developing a Web page there are variety of styles applied to various HTML elements. The cascade layer decides the styles that has to be applied to a specific element and the order in which it is applied. Figure 7.6 depicts a generic view of cascading.



Figure 7.6: Cascading in CSS

As the name suggests, CSS implies that styles are applied to HTML element in a cascading order. Styles can be applied to all the elements of the same type at a time. However, it can happen that out of same type of elements only one element of that type requires a specific style. This leads to multiple style being applied to the same element. Here, the style with highest specificity takes precedence. If two styles have the same specificity the one specified later is given higher precedence.

A good understanding of the cascade layer of CSS helps easy troubleshooting in case of errors or styling issues in CSS. It ensures correct application of styles to specified elements. A deep knowledge about cascade layers in CSS allows more efficient and optimum Web page development.

7.4 New Viewport Units

In CSS, viewport is the viewer area or the area that as seen by the user in the browser. This implicates that viewports vary depending on the size of the device. For example, laptop viewport size is much bigger than the viewport size of a mobile phone device. There are four viewports in CSS – `vw`, `vh`, `vmin`, and `vmax`. Viewport is one of the most important characteristics to make Web pages responsive. The units, `vmin` and `vmax`, are recent additions to viewport units. The newer viewport units work similar to the older ones. However, they consider the smallest or largest dimension of the viewport.

`vmin` stands for viewport minimum and `vmax` is viewport maximum. `vmin` takes into account the smaller of the width or height of the viewport. `Vmax` considers the larger of the two. Suppose, viewport of a particular Website has width 800 px and height is 600 px. Then, `1vmin` represents 6 px (the smaller of the two). On the other hand, `1vmax` represents 8 px for the same example. This indicates that `1vmin` represents 1% of the smaller dimension of the viewport and `1vmax` represents 1% of the larger dimension.

A setting as such makes the Web page more responsive as the size of the element remains consistent even if the viewport varies in size.

Code Snippet 3 shows `vmin` and `vmax` settings in CSS.

Code Snippet 3:

```
.element {  
    width: 50vmin;  
    height: 30vmax;  
    font-size: 5vmin;  
}
```

Code Snippet 3 illustrates that the width of the element is 50% of the smaller dimension of the viewport, while the height is 30% of the larger dimension. The font size is set to `5vmin` which allows it to adjust dynamically based on the size of the viewport.

`vmin` and `vmax` units are recent units. Even though these units are supported by majority of the modern browsers, it is best to test the performance on multiple browsers to ensure consistent behavior.

7.5 :has()

The `:has()` is a CSS pseudo-class introduced in CSS Selectors Level 4 specification. The `:has()` pseudo-class allows to select a specific parent element based on their descendent. Its syntax is as follows:

```
parent:has(child) {  
    /* Styles to apply to the parent element */  
}
```

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Code Snippet 4 provides an example of `:has()` pseudo-class.

Code Snippet 4:

```
. ul:has(li:nth-child(odd)) {  
    background-color: lightgray;  
}
```

In Code Snippet 4, the `ul` element is selected if it contains one or more `li` elements that are odd-numbered, that is, the first, third, fifth, and so on. The background color of the `ul` element is then set to light gray.

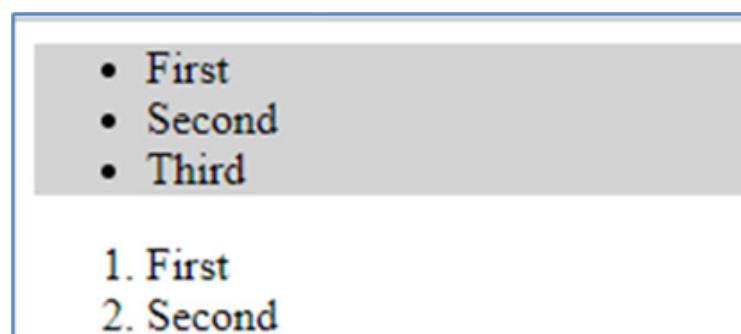


Figure 7.7: Output of Code Snippet 4

The `:has()` pseudo-class is not widely supported in all of the major browsers. A few browsers such as Safari and Firefox currently support it as shown in Figure 7.8. This compatibility chart is obtained from <https://caniuse.com/css-has>.

Chrome	Edge *	Safari	Firefox	Opera	IE	Chrome for Android	Safari on iOS *	Samsung Internet	Opera Mini *	Opera Mobile *	UC Browser for Android	Android Browser *	Firefox for Android	QQ Browser	B
4-100															
101-104	12-104	3.1-15.3	2-102	10-90			3.2-15.3								
105-109	105-109	15.4-16.2	103-109	91-94	6-10		15.4-16.2	4-19.0		12-12.1		2.1-4.4.4			
110	110	16.3	110	95	11	110	16.3	20	all	73	13.4	109	110	13.1	
111-113		16.4-TP	111-112				16.4								

Figure 7.8: Browser Compatibility for `:has()` pseudo-class

When compatible with other major browsers, it is sure to make a positive impact on styling of the Web elements.

7.6 @when/@else

It sometimes becomes necessary for the CSS authors to introduce conditionals inside the style sheet. In such scenarios, the CSS authors are required to combine rules to create conditionals.

Consider Code Snippet 5.

Code Snippet 5:

```
@when media (max-width: 769px) and supports(display: grid) and supports(display: flex) {  
    .grid {  
        grid-template-columns: 1fr;  
    }  
  
    .flex {  
        flex-direction: row;  
    }  
}
```

In Code Snippet 5, @support rule checks if the browser supports both grid and flexbox. If the browser does not support both of these features, the styles inside the block is be ignored. The media query applies these styles only when the viewport width is less than or equal to 769px. If both conditions are met, then the styles inside the `.grid` and `.flex` classes are applied.

Thus, `@when` and `@else` are very good features to be introduced in CSS. However, they are not an easy feature to introduce as the CSS authors should consider all the scenarios.

7.7 Accent Color

Accent color specifies coloring the various elements in the Web page. The elements can be buttons, labels, text input box, and so on. Properties of CSS such as color and background-color colors the elements accordingly. The accent color is enhanced further when it is combined with `:focus-visible` pseudo-class. This class applies focus onto a certain element only when focused through a keyboard. Consider the Code Snippet 6.

Code Snippet 6:

```
button {  
    accent-color: blue;  
}  
  
button:focus:not(:focus-visible) {  
    outline: none;  
    box-shadow: none;
```

```
}
```



```
button:focus-visible {  
    outline: 2px solid blue;  
    box-shadow: 0 0 2px 2px rgba(0, 0, 255, 0.5);  
}
```

Here, the `accent-color` property is set to blue and provides a focus style for buttons. In this case, the `accent-color` property is set to blue for all button elements. The `:focus-visible` pseudo-class gives the button blue outline and shadow when focused with a keyboard. The `:focus:not(:focus-visible)` pseudo-class is applied to remove the default focus style.

Accent-color is included in the CSS Color Adjustment Module Level 1 specification which is currently in progress. The `:focus-visible` is not supported in all browsers, particularly older versions.

7.8 Scroll Timeline

The **Scroll** behavior in CSS defines the scroll effect for a CSS scroll container when the user scrolls the Web page with mouse, trackpad or touch gesture. The `Scroll-Timeline` property is a way to create animations that respond to scroll position. Timelines are sequences of keyframes that defines how the animation changes over time. The **CSS Scroll Timeline** module refers to the timeline in context to a specific scroll container. It represents the scroll position of that container over time.

Code Snippet 7 illustrates a regular CSS animation.

Code Snippet 7:

```
div  
@keyframes adjust-progressbar {  
    from {  
        transform: scaleX(0);  
    }  
    to {  
        transform: scaleX(1);  
    }  
}
```

The `@keyframes` rule in CSS applies animations to elements. The `adjust-progressbar` is the name of the keyframe that creates an animation to scale an element along the x-axis from 0 to 1.

Now, attach it to an element using the animation property as shown in Code Snippet 8.

Code Snippet 8:

```
#progressbar {  
    animation: 1s linear forwards adjust-progressbar;  
}
```

In Code Snippet 8, an animation is applied to the #progressbar element by applying the animation shorthand property.

In Scroll-Timeline, define keyframes using the @scroll-timeline rule. A scroll offset value is specified instead of specifying a percentage for each keyframe. The scroll offset represents the distance that the element has been scrolled, as a percentage of the total scroll range of the element.

Code Snippet 9 is an example of @scroll-timeline rule.

Code Snippet 9:

```
@scroll-timeline scroll-in-document-timeline {  
    orientation: vertical;  
    scroll-offsets: 0%, 100%;  
    source: auto;  
}
```

As can be seen from Code Snippet 9, CSS rule creates a Scroll-Timeline called scroll-in-document-timeline. The orientation:vertical; property specifies orientation of the Scroll-Timeline to vertical, that is, the scroll offset values represents the vertical distance that the element has been scrolled. The scroll-offsets: 0%, 100%; sets the scroll offsets for the Scroll-Timeline. In this case, there are two scroll offsets: 0% and 100%. The first scroll offset (0%) represents the top of the element, and the second scroll offset (100%) represents the bottom of the element. The source: auto; property specifies the source of the Scroll-Timeline. It is the whole document by default. For the source to be a different element set source: #my-element.

As the user scrolls the element, the animation defined in this Scroll-Timeline plays and progresses based on the current scroll offset. The 0% refers to the top of the element and 100% bottom of the element. Orientation refers to the direction of scrolling initiates the animation and is set to vertical by default.

7.9 Nesting

Nesting in CSS helps to nest selectors and their corresponding declarations inside one another. This indicates that a child selector can be nested inside a parent selector such that it works relative to the parent selector rules.

Frontend Technologies for Beginners

This is well explained with the help of Code Snippet 10.

Code Snippet 10:

```
<html>
<head>

    <style>
        p a {
            color: green;
        }
        table tr th {
            background-color: gray;
        }
    </style>
</head>

<body>

    <p>
        This Para is meant for Googly Corporation <a href="http://www.googly.com">Googly</a>
    </p>

    <table style="width: 100%">
        <tr>
            <th>Name</th>
            <th>Age</th>
        </tr>
        <tr>
            <td>Tyler King</td>
            <td>50</td>
        </tr>
        <tr>
```

```
<td>Michael</td>
<td>65</td>
</tr>
<tr>
<td>Sam</td>
<td>26</td>
</tr>
</table>
</body>
</html>
```

Code Snippet 10 illustrates an HTML code with embedded CSS. The CSS styles applies nesting to target specific elements within their parent elements. In the example, the first CSS rule targets **a** element that are nested within **p** elements. It sets their color to green. The second CSS rule targets **th** elements that are nested within **tr** elements that are in a table element. It sets their background color to gray.

Name	Age
Tyler King	50
Michael	65
Sam	26

Figure 7.9: Output of Code Snippet 10

The HTML code has a paragraph element with a link, and a table with three rows and two columns. As can be seen in Figure 7.9, in a browser, the link in the paragraph takes green color and the headers in the table take gray background color.

Thus, nesting makes the CSS group related styles together and its modular design makes it more efficient.

7.10 Check Your Progress

1. Identify the correct purpose of CSS subgrid feature.

(A)	To create a grid layout that spans the entire page	(C)	To create a grid layout with a fixed number of columns and rows
(B)	Create nested grids within a single grid container	(D)	To apply styles to the contents of a grid container

2. What is the purpose of the gap property in flexbox?

(A)	It specifies the width of the flex container.	(C)	It specifies the height of the flex container.
(B)	It specifies the space between the flex items.	(D)	It specifies the space between the flex lines.

3. What is cascade in CSS?

(A)	The order in which CSS rules are applied to an element.	(C)	The process of combining multiple CSS files into a single file.
(B)	The hierarchy of HTML elements on a Web page.	(D)	The process of compressing CSS files to improve Website performance.

4. What are vmin and vmax units in CSS?

(A)	Units of measurement used to specify the width and height of an element.	(C)	Units of measurement used to specify the font size of text.
(B)	Units of measurement used to specify the minimum and maximum values of a range input.	(D)	Units of measurement used to specify sizes relative to the viewport dimensions.

5. How is vmin calculated?

(A)	It is equal to 1% of the viewport's height or width, whichever is larger.	(C)	It is equal to 1% of the viewport's height or width, whichever is smaller.
(B)	It is equal to the sum of the viewport's height and width, divided by 100.	(D)	It is equal to the difference between the viewport's height and width, divided by 100.

7.10.1 Answers

1.	B
2.	B
3.	A
4.	D
5.	C

Summary

- ➔ CSS subgrid enables the creation of nested grids with consistent track alignment thus, making it easier to design flexible and complex layouts.
- ➔ Flexbox Gap property of CSS helps add space between child items of a container.
- ➔ Cascade layers determine how CSS rules are applied to an HTML page during a Web page development.
- ➔ The vmin and vmax, are recent additions to viewport units.
- ➔ Accent color specifies the coloring of various elements in the Web page.
- ➔ The Scroll behavior in CSS defines the scroll effect for a CSS scroll container when the user scrolls the Web page with mouse, trackpad, or touch gesture

Try it Yourself

Make a simple Web page layout with three columns that are all the same size. Create a container div first, then set the display and flex-wrap properties to ‘flex’ and ‘wrap’, respectively. Finally, to create spacing between the columns, set the ‘gap’ attribute to the appropriate value. Lastly, inside the container div, create three child divs, and give each one a width of 33.33%. Observe how the ‘gap’ attribute creates space between the columns while maintaining their uniform sizes by adding some material to each one.



Session - 8

HTML Layout, Forms, and Elements

Welcome to the Session, **HTML Layout, Forms and Elements**.

This session explains navigation bar, HTML5 semantic tags and layout. This session also explains the usage of divisions in HTML5. Then, this session describes new features in HTML5 forms, working of new input types, new form attributes, new form field attributes, and new form elements.

In this Session, you will learn to:

- ➔ Explain HTML5 semantic tags and semantic tag layouts
- ➔ Explain the usage of navigation bar
- ➔ Explain divisions in HTML5
- ➔ Describe HTML5 forms
- ➔ Explain the working of new input types in HTML5
- ➔ Explain the new Form attributes
- ➔ Explain the new Form elements
- ➔ Define hidden fields

8.1 HTML5 Semantic Tags

HTML5 has evolved by introducing new elements that brought semantics to higher level. New tags were developed to create stable semantic structure. HTML5 has introduced two types of semantic tags namely, structural and text-level.

8.1.1 Structural Semantic Tags

They are the block level elements and are used to structure pages. The new structural semantic elements are as listed in Table 8.1.

Tag	Description
Section	The section element represents a section of a Web document. It is used for grouping related content and is different from other content groups present on the Web page. It is similar to a div tag though section element has more semantic meaning. In other words, section element is more meaningful as the content inside the section tags should be related.
Header	The header element represents the header of a Web page. It can be used either at the top of the document or at the top of a section. Though most of the Websites currently uses a single header at the top of the page called masthead, but a Web developer can have multiple headers in a single HTML5 document. This element is used as a container containing a group of introductory content or a set of navigational links.
Footer	The footer is similar to the header and can be present as the footer either for the document or for the section. There can be multiple footer elements in an HTML5 document. A footer element has information about the Web document. The typical contents which are placed in footer include Authors information, Copyright information, and Text-based navigation bar. Any metadata for the section can also be included in a footer tag.
Aside	The aside element is used for representing the content that is related to the main text of the document. It aligns itself as a sidebar. As compared with other structural tags its importance is not related with its position within a document, but rather its relationship with the content. It is not mandatory to have an aside element aligned to the right or left of a Web page. It can be at the top, the bottom, or even in the middle of a Web page.
Nav	The nav element represents a section of a Web page that contains navigation links/menus to other Web pages or to other parts within the Web page. In other words, it allows the user to navigate through the Web page and site. This section is created for major navigational information such as a navigation bar for the entire site or for a subsection menu.

Tag	Description
Article	The article element represents a section of content that is independent of a Web page or site content. It is self-contained and stands on its own. The possible sources for the article tag could be Blog post, News story, Comment, Review, and Forum post.

Table 8.1: Structural Semantic Tags

Note - The div tag must not be entirely replaced by the semantic tags. The semantic tags must only be used for semantically appropriate scenarios.

8.1.2 Text level Semantic Tags

The text level semantic tags are currently inline elements and they are listed in Table 8.2.

Tag	Description
Mark	The <mark> tag is used for defining marked or highlighted text because of its relevance to the context. For example, a mark tag can be used for highlighting words in a Web page that a visitor searched for.
Time	The <time> tag is used for defining either the time, or a date in the Gregorian calendar. It is used optionally with a time and a time-zone offset. This element can be used to encode dates and times in a machine-readable format. For example, a Web user can add birthday reminders or scheduled events to the user's calendar and enable the search engines to produce better search results. Attributes and value of <time> tag are as follows: datetime: Provides the date/time given by the element's content pubdate: It is used for specifying publication date and time of the document
Meter	The <meter> tag displays markup or scalar measurement within a defined range. Absolute scalar values, such as height or weight, are not represented automatically by the meter tag. For this, the user must specify the height and weight within the known range of values. It is also used for displaying fractional value.
Progress	The <progress> tag can be used with JavaScript to display the progress of a task.

Code Snippet 1 demonstrates the code to display date and time.

Code Snippet 1:

```
<!DOCTYPE html>
<html>
<body>
<time datetime="13:00">1pm</time><br>
```

```
<time datetime="2011-07-15">July 15th, 2011</time><br>
<time datetime="2011-07-15T13:00">1pm on July 15th</time>
</body>
</html>
```

The `datetime` attribute is not mandatory.

Code Snippet 2 demonstrates the code to display date.

Code Snippet 2:

```
<time>2011-07-14</time>
```

Code Snippet 3 demonstrates the code to display `<meter>` tag.

Code Snippet 3:

```
<meter value="2" min="0" max="10">2 out of 10</meter>
```

This displays a bar with a green indicator for the measurement.

Table 8.2 lists attributes and value of `<meter>` tag.

Attribute	Value	Description
form	form_id	Is used for specifying one or more forms to which <code><meter></code> belongs
high	number	Is used for specifying high range value
low	number	Is used for specifying a range of value that is to be considered as low and should be greater than min attribute value
max	number	Is used for specifying maximum value of the range
min	number	Is used for specifying minimum value of the range
optimum	number	Is used for specifying optimal value for <code><meter></code> tag
value	number	Is used for specifying current value of <code><meter></code> tag

Table 8.2: Attributes and Value of `<meter>` Tag

Table 8.3 lists attributes and value of `<progress>` tag.

Attribute	Value	Description
max	number	Is used for specifying the work as a floating point number that the task requires in total
value	number	Is used for specifying how much task has been completed

Table 8.3: Attributes and Value of `<progress>` Tag

Code Snippet 4 demonstrates the code to display `<progress>` tag.

Code Snippet 4:

```
<progress value="24" max="120"></progress>
```

8.2 HTML5 Semantic Layout

The sample representation of a Web page layout is displayed in Figure 8.1. The `<section>` element is used to explain each section defined and the purpose of each section.

In other words, Figure 8.1 shows the HTML5 semantic layout and used elements for each section.

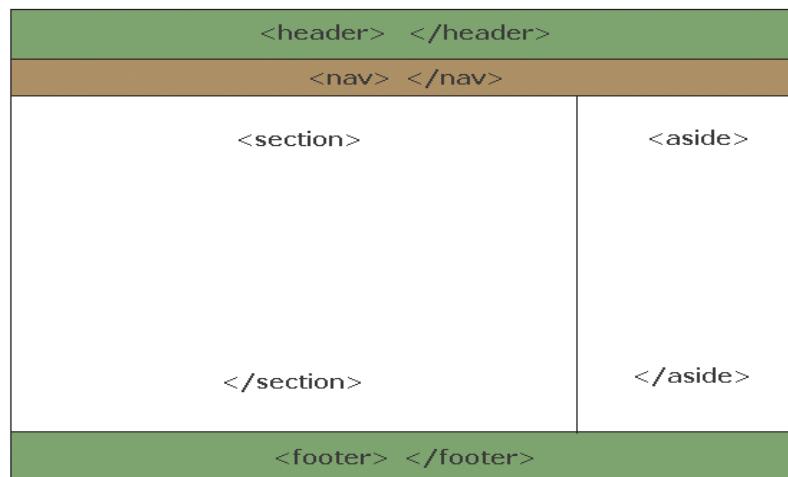


Figure 8.1: HTML5 Semantic Layout

→ **<header>**

The `<header>` element provides introductory information. This information can include titles, subtitles, logos, and so on. It can also include the navigational aids. The `<head>` tag provides information about the entire document, whereas the `<header>` tag is used only for the body of the Web page or for the sections inside the body.

Code Snippet 5 demonstrates the use of `<header>` tag.

Code Snippet 5:

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="utf-8">
    <title>My First Page</title>
  </head>
  <body>
    <header>
      <h1>Sample Blog </h1>
    </header>
  </body>
</html>
```

In the code, the `<header>` element shows the commencement of the body. This is the visible part of the document. Inside the `<header>`, the `<h1>` element is used to indicate the importance of the heading.

→ **<nav>**

The nav element is a section which contains the links to other pages or links to different sections within the page. In other words, it is a section containing the navigation links. Navigational elements are helpful in identifying large blocks of navigational data and are generally not preferred for small navigational displays.

Code Snippet 6 demonstrates the use of <nav> tag.

Code Snippet 6:

```
<body>
<header>
<h1>Sample Blog</h1>
</header>
<nav>
<ul>
<li>home </li>
<li>help </li>
<li>contact </li>
</ul>
</nav>
</body>
```

In the code, the <nav> element is present between the <body> tags, but after the closure of <header> tag.

→ **<section>**

It is the main information bar that contains the most important information of the document and it can be created in different formats. For example, it can be divided into several blocks or columns.

For example, a Website's home page could be divided into sections for an introduction, news updates, and contact information.

Code Snippet 7 demonstrates the use of <section> tag.

Code Snippet 7:

```
<body>
<header>
<h1>Sample Blog </h1>
</header>
<nav>
<ul>
<li>home </li>
<li>help </li>
```

```
<li>contact </li>
</ul>
</nav>
<section>
<h1>Links</h1>
<ul>
<li><a href="#">Link 1</a></li>
<li><a href="#">Link 2</a></li>
<li><a href="#">Link 3</a></li>
</ul>
</section>
</body>
```

Similar to the navigation bar, the main information bar is a separate section. Therefore, the main information bar appears after the `</nav>` closing tag.

→ **<aside>**

The `<aside>` element is a column or a section that generally contains data linked to the main information, but not as relevant or important as the main information. This element is used for typographical effects, such as for sidebars, for groups of `nav` elements, for advertising purposes, and for other content that cannot form a part of the main content of the page.

Code Snippet 8 demonstrates the use of `<aside>` tag.

Code Snippet 8:

```
<!DOCTYPE html>
<html lang="en">
<body>
<header>
<h1>Sample Blog </h1>
</header>
<nav>
<ul>
<li>home </li>
<li>help </li>
<li>contact </li>
</ul>
</nav>
<section>
<h1>Links</h1>
<ul>
```

```
<li><a href="#">Link 1</a></li>
<li><a href="#">Link 2</a></li>
<li><a href="#">Link 3</a></li>
</ul>
</section>
<aside>
<blockquote>Archive Number One</blockquote> <br>
<blockquote>Archive Number Two</blockquote>
</aside>
</body>
</html>
```

The `<aside>` element can be placed in any part of the site layout. It can also be used in any way as long as the content is not considered as the main content of the document. Figure 8.2 shows output of Code Snippet 8.

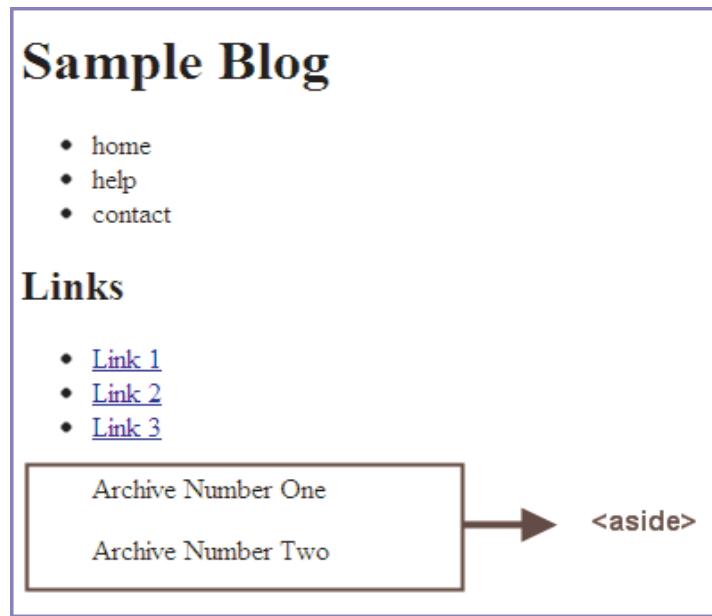


Figure 8.2: Output of Code Snippet 8

→ **<footer>**

HTML5 provides the `<footer>` element to give an end to the document's body. A footer typically contains information about the sections. This can include the author or company details, links to related documents, copyright data, and so on.

Code Snippet 9 demonstrates the use of `<footer>` tag.

Code Snippet 9:

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="utf-8">
</head>
<body>
<header>
<h1>Sample Blog </h1>
</header>
<nav>
<ul>
<li>home </li>
<li>help </li>
<li>contact </li>
</ul>
</nav>
<section>
<h1>Links</h1>
<ul>
<li><a href="#">Link 1</a></li>
<li><a href="#">Link 2</a></li>
<li><a href="#">Link 3</a></li>
</ul>
</section>
<aside>
<blockquote>Archive Number One</blockquote> <br>
<blockquote>Archive Number Two</blockquote>
</aside>
<footer>
Copyright © 2021-2023
</footer>
</body>
</html>
```

Usually, the `<footer>` element represents the end of the body section. However, the `<footer>` tag can be used many times inside the body to represent the end of different sections.

Figure 8.3 shows output of Code Snippet 9.

The screenshot displays a web page with a purple header bar. The main content area has a white background and features a large dark blue header 'Sample Blog'. Below the header is a navigation menu with three items: 'home', 'help', and 'contact', each preceded by a small dark blue circle. A section titled 'Links' follows, containing three blue underlined links labeled 'Link 1', 'Link 2', and 'Link 3'. Underneath these links are two sections labeled 'Archive Number One' and 'Archive Number Two'. At the bottom of the page is a footer bar with a purple border, containing the text 'Copyright © 2021-2023' on the left, a right-pointing arrow in the center, and '<footer>' on the right.

Figure 8.3 Output of Code Snippet 9

→ **<article>**

The `<article>` element helps to insert a self-contained composition in an application, page, document, or site. For example, an `<article>` element could be an interactive widget, an entry in a blog, an article in a newspaper or magazine, a post in a forum, a comment submitted by a user, or any other independent content.

Code Snippet 10 demonstrates the code for `<article>` tag.

Code Snippet 10:

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="utf-8">
</head>
<body>
<header>
<h1>Sample Blog </h1>
</header>
<nav>
<ul>
<li>home </li>
```

```
<li>help</li>
<li>contact </li>
</ul>
</nav>
<section>
  <article>
    First Blog entry
  </article>
  <article>
    Second Blog entry
  </article>
</section>
<aside>
<blockquote>Archive Number One</blockquote>
<blockquote>Archive Number Two</blockquote>
</aside>
<footer>
  Copyright &copy; 2021-2023
</footer>
</body>
</html>
```

In the code, the `<article>` tags are placed within the `<section>` tags. This indicates that the `<article>` tag belongs to this section. The `<article>` tags are placed individually one after another, because each one is an independent part of the `<section>`.

Figure 8.4 shows output of Code Snippet 10.

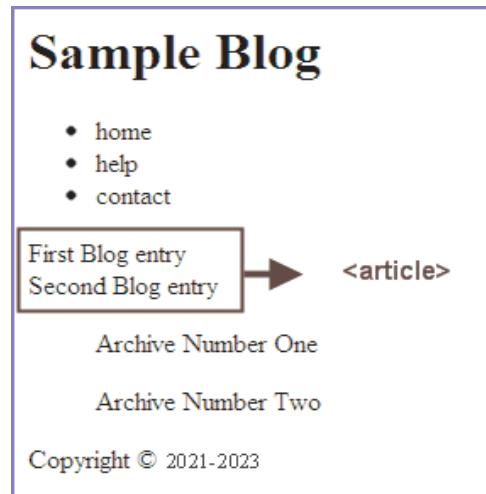


Figure 8.4: Output of Code Snippet 10

Figure 8.5 shows the new layout, after adding the `<article>` tag.

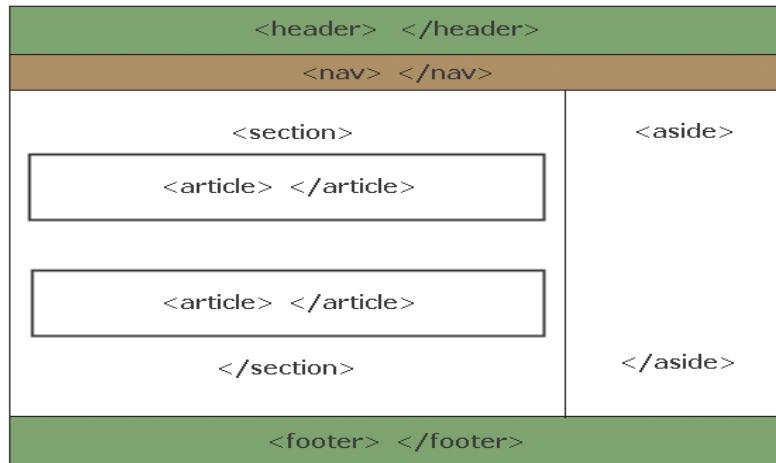


Figure 8.5: New Layout after Adding the `<article>` tag

The content of Website `<article>` element has its own independent structure.

8.3 Navigation Bar

Navigation is one of the most important elements in Web design. In Web designing, a navigation menu is always on navigation bars, which can be horizontal or vertical. A navigation bar is a section of a Website or online page intended to support visitors in browsing through the online document. Typically, Web pages will have a primary and a secondary navigation bar on all pages which will include links to the most important sections of the site.

8.3.1 Text-based Navigation Bar

Navigation menu is the most used element than any other element on any Web page. Therefore, it is important to make sure that the Website visitors should be able to easily navigate through the site structure. The advantage of using a text-based navigation bar is that it reduces the loading time of a page. Although a text-based navigation bar is easy to create, it is not interesting because there is very less interaction or visual appeal to the visitor. Text links are hard to distinguish from the regular text that appears on a Web page.

It can be displayed either horizontally or vertically. The font (best to use Web safe fonts), color, and link colors can be determined by the user via the Font pane.

Code Snippet 11 demonstrates the HTML code for a text-based navigation bar.

Code Snippet 11:

```
<!DOCTYPE html>
<html>
<head>
</head>
```

```
<body>
<nav>
<a href="/home/"><font size="6">Home</font></a> | 
<a href="/news/"><font size="6">News</font></a> | 
<a href="/contact/"><font size="6">Contact</font></a> | 
<a href="/about/"><font size="6">About</font></a>
</nav>
<h1>This is a Text-based Navigation Bar</h1>
</body>
</html>
```

Figure 8.6 shows the output of text-based navigation bar.



Figure 8.6: Output of Text-Based Navigation Bar

8.4 Divisions

The `<div>` tag defines a division in an HTML Web page. It is used to group block-elements and format them with CSS. The new structural semantic tags reasonably reduce a lot of `<div>` tag's usage, but `<div>` tag is still important in the HTML5 world. The `<div>` tag can be used when there is no other semantically appropriate element left that suits the purpose in a Web page development. It can be commonly used for stylistic purposes such as wrapping some semantically marked-up content in a CSS-styled container.

Code Snippet 12 demonstrates an HTML code to show the use of `<div>` tag used for wrapping.

Code Snippet 12:

```
<body>
<div id="wrapper">
<header>
<h1>Hello</h1>
<nav>
<! -- . . . -->
</nav>
</header>
</div>
</body>
```

Tips for using `<div>` tag in Website development are as follows:

- ➔ The `<div>` tag is a block-level element.

- The <div> tag can contain any other tag.
- In HTML5, the <div> tag can be found inside any element that can contain flow elements, such as other <div>, <address>, <section>, and <table>.

8.4.1 Division Positioning and Formatting

Elements can be positioned using the top, bottom, left, and right properties. However, these properties will not work unless the position of the property is set. They also work differently depending on the positioning method. There are five position properties in DIV elements namely, static, relative, absolute, fixed, and inherit. For easy usage, only three properties are used namely, absolute, relative, and fixed. Positioning can be applied to any block element. The default position for a block element (DIV) is static. Table 8.4 shows various values that can be used in DIV element to position elements.

Value	Description
static	Positions elements in order, as they appear in document flow. It is the default value.
absolute	Positions element relative to its first position.
fixed	Positions element relative to the browser window.
relative	Positions element relative to its normal position.
inherit	Positions element with respect the value that is inherited from the parent element.

Table 8.4: Values For Positioning With the DIV Element

Code Snippet 13 demonstrates the CSS code for <div> tags with different position properties.

Code Snippet 13:

```
.lCard{  
width: 100px;  
height:100px;  
background-color:blue;  
padding: 6px;  
position:fixed;  
left:450px;  
top:100px;  
}  
.rCard{  
width: 100px;  
background-color:red;  
padding: 7px;  
position:relative;  
top:93px;
```

```
left:300px;  
}  
.bCard{  
width: 100px;  
height:100px;  
background-color:green;  
padding: 6px;  
position:absolute;  
left:310px;  
bottom:320px;  
}
```

Include the div tag within the style section of the HTML body. Code Snippet 14 demonstrates HTML code for <div> tags.

Code Snippet 14:

```
<body>  
    <div class="rCard">  
    </div>  
    <div class="bCard">  
    </div>  
    <div class="lCard">  
    </div>  
</body>
```

Figure 8.7 shows the output of division positioning. Note that output may differ from browser to browser depending on browser width and screen size.

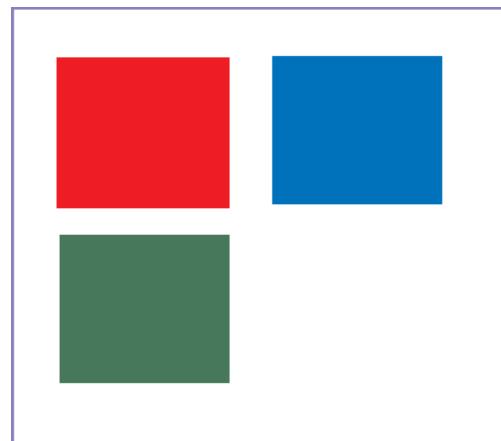


Figure 8.7: Output of Division Positioning

Multiple columns are created by using the <div> tag and CSS is used to format the divisions. Divisions can be formatted by using the same character, paragraph, and page formatting styles. In the Code Snippet, CSS is used to format each DIV.

8.5 Introduction to HTML5 Forms

In HTML5, creation of form is made easier for Web developers by standardizing them with rich form controls. It also provides client-side validations that are now handled natively by the browsers. This not only reduces the load time of the pages, but also removes the necessity of the repetitive JavaScript codes to be included on the page.

The HTML `<form>` element is used to create an HTML form that can accept user input. This element acts as a container for different types of input elements, namely, text fields, check boxes, radio buttons, submit buttons, and so on.

Table 8.5 lists some of the most commonly used input types in HTML forms.

Type	Description
<code><input type="text"></code>	Displays a single-line text input field
<code><input type="radio"></code>	Displays a radio button
<code><input type="checkbox"></code>	Displays a check box
<code><input type="submit"></code>	Displays a submit button
<code><input type="button"></code>	Displays a clickable button

Table 8.5: Common Input Types in HTML5

The `action` attribute in the `form` element defines the action to be performed when the form is submitted.

Code Snippet 15 shows a simple markup for a form that accepts user data and transfers control to another HTML page. In this case, the data is not being processed since, it is a simple example. In practical scenarios however, form data is often sent to a file on the server for processing when user clicks the submit button.

Code Snippet 15:

```
<!DOCTYPE html>
<html>
<head>
<title>FormDemo</title>
</head>
<body>
<form method="get" action="test.html">
<label>Enter Your Name:</label><br />
<input type="text" value="" id="name" /><br />
<label>Enter Your Age:</label><br />
<input type="text" value="" id="age" /><br />
<label>Are You an Employed Person:</label><br />
<input type="radio" value="Yes" id="Yes" />
<label for="Yes">Yes</label><br />
<input type="radio" value="No" id="No" />
```

```
<label for="No">No</label><br>
<br />
<input type="submit" value="Submit" />
</form>
</body>
</html>
```

Code Snippet 16 shows the code for **test.html**.

Code Snippet 16:

```
<!DOCTYPE html>
<html>
<body>
Hello
</body>
</html>
```

Figure 8.8 depicts output of Code Snippet 16.

The figure shows a simple HTML form with the following structure:

```
<form>
  <input type="text" name="name" placeholder="Enter Your Name:">
  <input type="text" name="age" placeholder="Enter Your Age:">
  <p>Are You an Employed Person:</p>
  <input type="radio" name="employed" value="Yes"/> Yes
  <input type="radio" name="employed" value="No"/> No
  <input type="button" value="Submit" />
</form>
```

Figure 8.8: Output Showing HTML Form

8.6 New Features in HTML5 Forms

HTML5 Web forms bring great improvements related to form creation for the Web developers and also for users interacting with them.

Note - The state of HTML5 is changing continuously to improve. Thus, support for new form elements, attributes, and input types can vary across different browsers.

8.6.1 New Input Types

The `input` element is a data field that allows the user to edit the data on the form. It has an attribute named `type` which controls the data type and characteristics of the `input` element.

Table 8.6 lists the new input types supported by HTML5 that specify the kind of input expected from the users on the Web page.

Type	Description
email	Represents the completion progress of a task on the page
search	Represents a scale of known range
url	Represents a set of options used with list attribute to make a drop-down control
tel	Represents the result of a calculation
number	Represents a numeric value in the input field
range	Represents a numeric value to be selected from a range of numbers
date	Represents a calendar which is shown at each click upon the field
week	Represents date in year-week format
month	Represents a value with year-month format
time	Represents a value in hours and minutes format
datetime	Represents a full date and time input field with a time zone
color	Represents a predefined interface for selecting color

Table 8.6: New Input Types Supported by HTML5

8.6.2 New Attributes

HTML5 has introduced several new attributes that can be used with `form` and `input` elements. Attributes help the elements to perform their tasks. Table 8.7 lists the new attributes in HTML5.

Type	Description
placeholder	Represents a hint that help users to enter the correct data in the field
required	A Boolean attribute that validates the entry in the field
multiple	A Boolean attribute that allows multiple values to be entered in the field
autofocus	Focuses the input element on page load
pattern	Represents a regular expression for validating the field's value
form	Allows the elements to reference the form by including the form name

Table 8.7: New Attributes in HTML5

8.6.3 Browser-based Validation

HTML4 supported the use of custom JavaScript or libraries to perform validation on the client-side browsers. These validations ensure that the input fields are checked before the form is submitted to the server for further processing.

The new attributes in HTML5, such as `required` and `pattern` can be used with the `input` elements to perform validation. This relieves the Web developers from writing the custom JavaScript code for performing client-side validation on the Web pages. HTML5 also provides advanced validation techniques that can be used with JavaScript to set custom validation rules and messages for the `input` elements.

8.6.4 CSS Styling Techniques

A Web developer can enhance the form elements with the pseudo-class selectors, such as :required, :valid, and :invalid. For example, input fields which cannot be left blank while submitting the form can be displayed with an outline. To achieve this, input field with required attribute can be styled using CSS. Applying CSS styles make it easier for user to navigate and complete the form.

Code Snippet 17 shows CSS code for formatting non-empty and incorrect data input in the `input` element fields on the form.

Code Snippet 17:

```
<style>
  input:required {
    outline: 1px red solid;
    color: green ;
  }
<style>
  input:required {
    outline: 1px red solid;
    color: green ;
  }
  input:required:valid {
    background-size:10px 10px;
    background-position: right top;
    background-repeat: no-repeat;
  }
  input:required:invalid {
    background-size:10px 10px;
    background-position: right top;
    background-repeat: no-repeat;
  }
</style>
</head>
<body>
<form method="get" action="try.php">
Name: <input type="text" name="name" required="true" /><br />
Email: <input type="email" name="emailid" required="true" />
<input type="submit" value="Submit" />
</form>
```

8.6.5 Forms API

HTML5 has introduced JavaScript API for forms. This API is used to customize validations and processing performed on the forms. The new form's API provides new methods, events, and properties to perform complex validations combining fields or calculations.

Table 8.8 lists the events and methods.

Events and Methods		Description
setCustomValidity (message)		Sets the custom error message that is displayed when the form is submitted by the user
checkValidity()		Checks the validity of the e-mail address entered by the user
oninvalid		Allows script to run only when the element is invalid
onforminput		Allows script to run when the form gets an input from the user
onformchange		Represents a regular expression for validating the field's value
form		Allows script to run when the form changes

Table 8.8: Events and Methods

8.7 Working with New Input Types

The `type` attribute of the `input` element determines what kind of input will be displayed on the user's browser. The default input is `type="text"`.

The registration form in the session is using following input types:

- `text`
- `label`
- `radio`
- `textarea`
- `checkbox`
- `submit`

HTML5 has introduced more data-specific user interface elements. Now, you will see the new input types in detail.

8.7.1 E-mail Addresses

The `type="email"` is used for specifying one or more e-mail addresses. To allow multiple addresses in the e-mail field, separate each address with comma-separator.

In the registration form, the input type is changed from `text` to `email` as shown in Code Snippet 18.

Code Snippet 18:

```
<form method="get" action="test.html">  
    <label for="emailid">Email:</label>
```

```
<input type="email" value="" id="emailid" name="emailaddress"
       maxlength="255" />
<input type="submit" value="submit"/>
</form>
```

In the code, `<label>` tag defines a label for the element on the form. The `for` attribute of `<label>` tag binds it with the related element, that is `email` element, on the form. The value of `for` attribute must match with the value of `id` attribute assigned to the element.

Also, the `email` contains two attributes, namely `id` and `name`. The `id` attribute specifies a unique id for the element. The value of the `id` attribute should be unique within the document. It can be used as a reference for styles in style sheet or to access elements using DOM API in JavaScript.

The `name` attribute specifies a name for the `input` element. It can be used for referencing the elements in a JavaScript or form data after a form is submitted to the server for processing. The look of the input is still like a plain text field, but changes are applied behind the scenes. Browsers, such as Firefox, Chrome, and Opera will display a default error message if user submits the form with some unrecognizable contents.

Figure 8.9 shows the error message for incorrect e-mail address in Chrome.

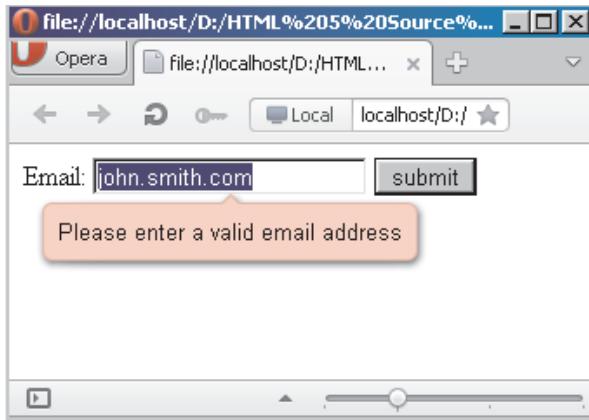


Figure 8.9: Error Message for Incorrect E-mail Address in Chrome

8.7.2 URL

The `type="url"` input element is used for specifying a Web address. The look of the `url` field is a normal text field. Code Snippet 19 shows the code of `url` input type.

Code Snippet 19:

```
<label for="url">Enter your Web page address:</label>
<input type="url" value="" id="urlname" name="urltext"
       maxlength="255" />
<input type="submit" value="submit"/>
```

Browsers, such as Opera, Firefox, and Chrome supports validation for the `url` input type. While validating the URL, browsers only checks for entry with forward slash (/).

For example, a URL such as **x://mysite.com** will be considered as valid, even though **x://** is not a real protocol.

Figure 8.10 shows the error message for incorrect URL in Chrome.

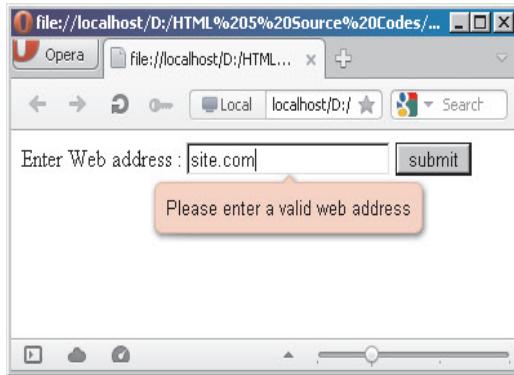


Figure 8.10: Error Message for Incorrect URL in Chrome

8.7.3 Telephone Number

The `type="tel"` input element is used for accepting telephone numbers. As compared to `email` and `url` types, the `tel` type does not impose a particular pattern. It supports characters, numbers, and special characters except new lines or carriage returns. The reason for not imposing any pattern for `tel` type is that different countries support various lengths and punctuation in the phone numbers. Thus, there cannot be a standard format for them. A user can enforce a pattern for `tel` input type by using `placeholder` or `pattern` attribute. A JavaScript code can also be provided for performing client-side validation on the `tel` input type.

Code Snippet 20 shows the code for including `tel` input type on the registration form.

Code Snippet 20:

```
<label for="telno">Telephone Number:</label>
<input type="tel" value="" id="telno" name="telephone_no"
       maxlength="10" />
```

8.7.4 Number

The input `type="number"` is used for accepting only number values. The `input` element displayed for `number` type is a spinner box. The user can either type a number or click the up or down arrow to select a number in the spinner box.

Code Snippet 21 shows the code for including number input type on the form.

Code Snippet 21:

```
<label for="stud_age">Age:</label>
<input type="number" value="15" id="stud_age"
```

```
name="studentage" min="15" max="45" step="1" />  
<input type="submit" value="submit"/>
```

In the code, the `number` input type has attributes, such as `min` and `max` to specify the minimum and maximum value for the input.

Figure 8.11 shows the `number` input type in Opera.

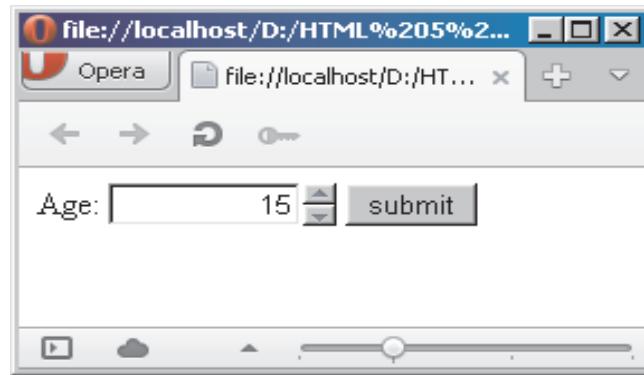


Figure 8.11: Number Input Type in Opera

8.7.5 Range

The `input type="range"` is similar to `number` type and displays a slider control on the page. The range type is used when the exact value is not required in the input. In other words, the value from this type is not accurate. For example, an online survey form asking the clients to rate the products may not receive exact values in the ratings.

Code Snippet 22 shows the code for including range `input` type with attributes `min` and `max`.

Code Snippet 22:

```
<label>Survey for packages offered[scale: 1-10]:</label>  
<input type="range" name="rating" min="1" max="10" />  
<input type="submit" value="submit"/>
```

In the code, the range input type contains attributes, such as `min`, `max`, `step`, and `value`. The `min` and `max` attributes are used to specify the minimum and maximum value allowed for a range and are set to 1 and 10 respectively. The `step` attribute specifies intervals for incrementing the value. The value of `step` attribute is 1 by default. The `value` attribute specifies the default value for the range. The default value is the midpoint of the range specified.

Figure 8.12 shows the range input type in Opera.

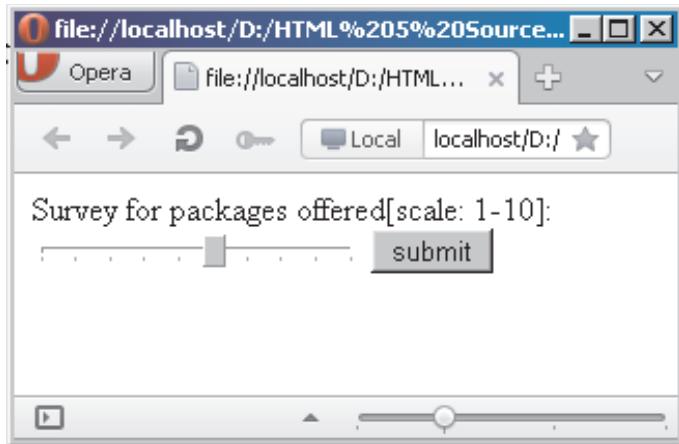


Figure 8.12: Range Input Type in Opera

Figure 8.13 shows the value for the range input type in the URL after the form is submitted by the user. The rating selected by the user can be seen in the Address Bar of the browser.

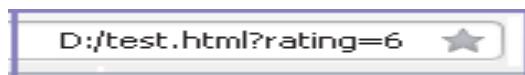


Figure 8.13: Value for the Range Input Type in URL

8.8 New Form Attributes

Earlier, Web developers required to write JavaScript snippets for performing the validations on the data entered by the users in form fields. HTML5 has provided several new attributes that perform the validations without writing JavaScript snippets for them. These attributes perform following tasks:

- Check data provided by users with the regular expression pattern assigned to the fields
- Inform users with appropriate errors
- Check that the required fields are not left empty by the users
- Enable multiple values for the fields, if provided

These attributes can be used to support scripting drawbacks, without actually hard coding them in the Web pages. Browsers that do not understand these new attributes will ignore them.

8.8.1 Required

This is a boolean attribute that informs the browser to submit the form only when the required fields are not left empty by the users. The input type elements, such as `button`, `range`, and `color` cannot be set for `required` attribute as they have a default value. Different Web browsers such as Opera, Chrome, and Firefox provide different error messages, such as 'This is a required field', or 'Please fill out this field' for `required` attribute.

Code Snippet 23 shows assignment of `required` attribute to the name field on the registration form.

Code Snippet 23:

```
<label>Name:<br>
<em>  </em>
</label> <br>
<input type="text" value="" name="first" size="8" tabindex="1"
required = "true"/>
<input type="text" value="" name="last" size="14" tabindex="2"
required="true"/>
<input type="submit" value="submit"/>
```

Figure 8.14 shows the message of required attribute in Opera.



Figure 8.14: Message of Required Attribute in Opera

8.8.2 Placeholder

This attribute displays a short hint or text inside a form element. This informs the user about what data must be entered in that field. The `placeholder` text toggles, which means it appears in the field and disappears when the user clicks inside the field. Earlier, Web developers provided this functionality through JavaScript snippets which is now done in the browsers with the help of `placeholder` attribute. At present, all the browsers such as Chrome, Safari, Opera, and Firefox support the `placeholder` attribute.

If the size of the hint exceeds the field size, then use `title` attribute to describe text for the field.

Code Snippet 24 shows the assignment of `placeholder` attribute to the name field on the registration form.

Code Snippet 24:

```
<label>Name: </label> <br>
<input type="text" value="" name="first" size="8" tabindex="1"
required="true" placeholder="First Name"/>
<input type="text" value="" name="last" size="14" tabindex="2"
required="true" placeholder="Last Name" /><br />
```

Figure 8.15 shows the message of placeholder attribute in Opera.

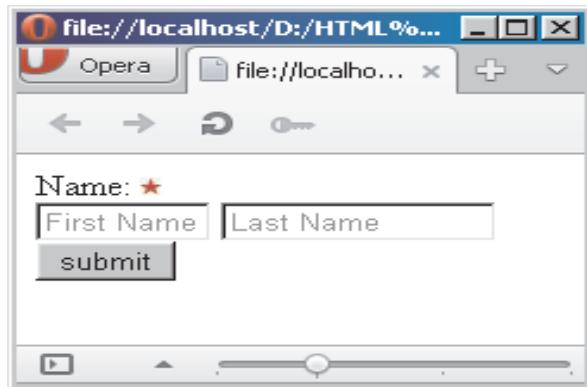


Figure 8.15: Message of Placeholder Attribute in Opera

8.8.3 Pattern

This attribute uses regular expressions for validating the fields. The data entered by the user must match with the pattern specified in the regular expression. This helps to limit the input accepted from the user. While including regular expressions through pattern attribute, it informs the users about the expected pattern for the data. This can be achieved in the current browsers using the title attribute, which is displayed as a tool tip when the users move the pointer over the field.

You must validate a zip code of five numbers on the form. There is no pre-defined input type to restrict the input to numbers of specified length. Thus, pattern attribute can be used to create user-defined check values for the field. Also, a title attribute can be used to customize the error message displayed for the field. Code Snippet 25 shows the assignment of pattern attribute to the phone number field on the registration form.

Code Snippet 25:

```
<label>Phone number:</label>
<input type="tel" value="" size="4" maxlength="5" tabindex="11"
required="true" placeholder="Code" pattern="[+0-9]{1,4}"
title="Format: (+) 99(99)"/>
<label>-</label>
<input type="tel" value="" size="10" maxlength="12"
tabindex="13" required="true" placeholder="Number"
pattern="[0-9]{8,}" title="Minimum 8 numbers"/>
```

In the code, `[+0-9]` pattern indicates that only special character '+' as well as numbers are allowed. Also, `{1, 4}` refers to the length of the numbers, that is between 1 and 4. Similarly, `{8,}` means minimum eight numbers are allowed in the `tel` input type field.

Figure 8.16 shows the message of pattern attribute in Opera.

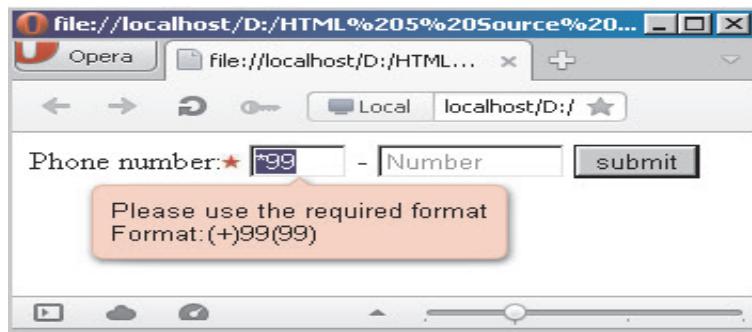


Figure 8.16: Message of Pattern Attribute in Opera

8.8.4 Multiple

This is a boolean attribute that allows multiple values for some input types. This was available only for select input type in the earlier version of HTML. HTML5 allows multiple attribute with input types, such as `email` and `file`. If assigned, it allows selection of multiple files or include several e-mail addresses in the `email` field separated by comma separator. At present, browsers such as Chrome, Opera, and Firefox support multiple attribute for `e-mail` and `file` elements.

Code Snippet 26 shows the assignment of multiple attribute to the e-mail address field on the registration form.

Code Snippet 26:

```
<label>Email Address:</label>
<input type="email" value="" name="emailid" maxlength="255" tabindex="5" required="true" placeholder="Email Address" multiple/>
```

In the code, multiple attribute will allow insertion of multiple e-mail addresses in the field. Each e-mail address will be validated individually by the browser.

Figure 8.17 shows the validation of multiple e-mail address.

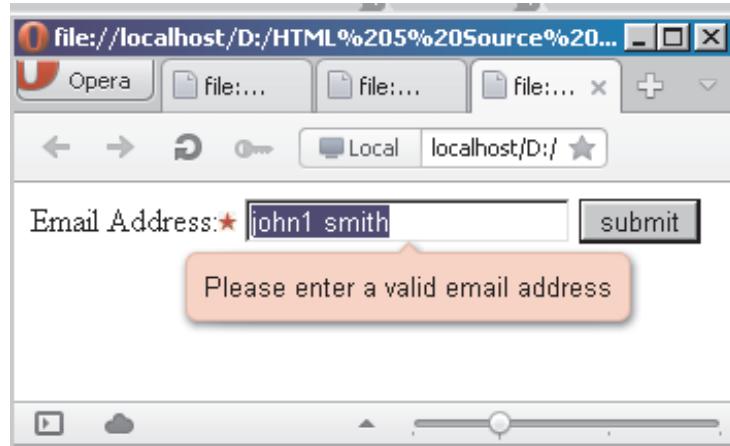


Figure 8.17: Validation of Multiple E-mail Address

8.8.5 Autofocus

Earlier, Web developers were using JavaScript code to set the focus to the input field on page load. The purpose was to force the focus over the input field, even if the user selected some other element while page is still loading. As a result of the JavaScript code, control moves to the input field upon completion of page load. This way, regardless of what the user selected, the focus would always be on the input field.

To provide an easier solution for this behavior, HTML5 has introduced `autofocus` attribute for the form elements. The `autofocus` attribute will focus on the input field on page load. However, depending upon the situation, it will not move the focus away if the user has selected some other field. Only one element can be focused with `autofocus` attribute on a particular page while loading.

Code Snippet 27 shows the assignment of `autofocus` attribute to the first name field on the registration form.

Code Snippet 27:

```
<label>Name:</label>
<br>
<input type="text" value="" name="first" size="8" tabindex="1"
       placeholder ="First Name" autofocus/>
<input type="submit" value="submit"/>
<br>
<label>First Name</label>
```

Figure 8.18 shows the behavior of `autofocus` attribute.

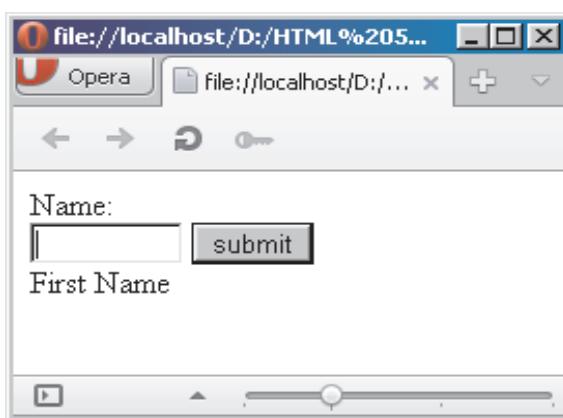


Figure 8.18: Behavior of Autofocus Attribute

8.8.6 Form

Earlier, all the form controls are required to be provided between the opening and closing `<form>` tag. In HTML5, elements can be inserted at any place in the document and they can reference the form using the `form` attribute.

Code Snippet 28 shows the association of an element with the form on the Web page.

Code Snippet 28:

```
<body>
<input type="text" name="mytext" id="mytext" form="myform"/>
. . .
<form id="myform">
. . .
</form>
</body>
```

In the code, the form is declared with an `id` attribute. The value of the `id` attribute is assigned to the `input` element using `form` attribute.

8.8.7 Autocomplete Attribute

Many browsers help user in filling forms by providing data in the input fields, such as `email` and `tel`, based on their earlier input. In many situations, the autocomplete behavior may not be secure, especially with certain fields accepting password or credit card number data.

HTML5 offers an `autocomplete` attribute which provides control on prefilled values displayed in the fields. It must be specified on the `form` element which applies for all input fields or on particular input fields. The `input` element that can support autocomplete are `text`, `url`, `tel`, `password`, `datepickers`, `range`, and `color`.

The `autocomplete` feature comprises two states namely, **ON** and **OFF**. The **ON** state indicates that the data that is not sensitive can be remembered by the browser. Similarly, the **OFF** state indicates that the data will not be remembered. Such data may be sensitive and not safe for storing with the browsers. Hence, user must explicitly provide the data each time while filling the form.

By default, many browsers have the `autocomplete` feature enabled in them. The browsers that do not support completion, can be turned **ON** or **OFF** for this behavior by specifying `autocomplete` attribute either on the form or specific input elements.

Figure 8.19 shows the behavior of `autocomplete` attribute in Chrome.

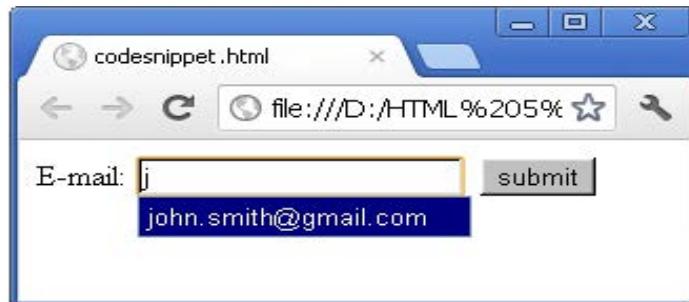


Figure 8.19: Behavior of Autocomplete Attribute in Chrome

Code Snippet 29 demonstrates to disable the default behavior of `autocomplete` attribute.

Code Snippet 29:

```
E-mail: <input type="email" name="email" autocomplete="off" />
        <input type="submit" value="submit" />
```

8.9 New Form Elements

HTML5 has introduced some brand new elements that can be incorporated in the Web pages. These new elements are specifically designed to be used with the JavaScript. When combined with JavaScript, these new elements can be more functional.

At present, all the browsers do not provide the support for these new elements. If the control is not supported by the browser, then it displays element as a text field. Opera provides the support for all the new form elements.

8.9.1 Datalist

Datalist is a form-specific element. It provides a text field with a set of predefined options that are displayed in a drop-down list. When the text field receives focus, a list of options is displayed to the user. The `<datalist>` element is very similar to standard `<select>` element available in earlier HTML. The only difference in `datalist` is that it allows the user to enter data of their choice or select from the suggested list of options.

The lists of options for `<datalist>` element are placed using `option` element. Then, the `datalist` is associated with an `input` element using the `list` attribute. The value of `list` attribute is the value of `id` attribute provided with the `<datalist>` element. The same `datalist` can be associated with several input fields. At present, only Opera browser provides the support for the `datalist`.

Code Snippet 30 shows the syntax of providing the `<datalist>` element on the form.

Code Snippet 30:

```
<label> Select the mode of payment: </label>
<input type="text" name="payment" list="paymentlist" />
<datalist id="paymentlist">
    <option value="Cash-on-Delivery">
    <option value="Net Banking">
    <option value="Credit Card">
    <option value="Debit Card">
    <option value="e-Gift Voucher">
</datalist>
<input type="submit" value="submit" />
```

In the code, a `datalist` requires `value` attribute to be added with the `<option>` tag. Values nested between the opening and closing `<option>` tag will not be displayed in the `datalist` menu.

Figure 8.20 shows the <datalist> element in Opera.

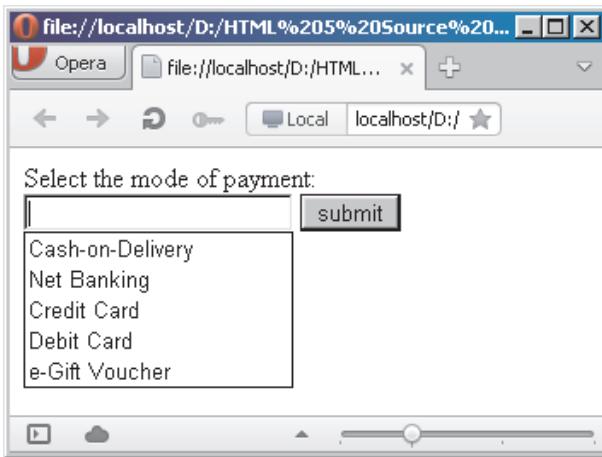


Figure 8.20: Datalist Element in Opera

As shown in Figure 8.20, the datalist is displayed with simple text field that shows the suggested list of options in a drop-down list on focus.

8.9.2 Progress

The progress element represents the current status of a task, which gradually changes as the task heads for completion. This is not a form-specific element. For example, when the user downloads any file from a particular Web page, the download task is represented as a progress bar.

Code Snippet 31 shows the syntax for providing progress element on the form.

Code Snippet 31:

```
<label> Downloading status: </label>
<progress value="35" max="100" ></progress>
<input type="submit" value="submit"/>
```

In the code, the progress element contains two attributes namely, `max` and `value`. The `max` attribute declares the maximum value for the task to be processed for its completion.

The `value` attribute indicates how much task has been processed so far. Figure 8.21 shows the progress element in Opera.

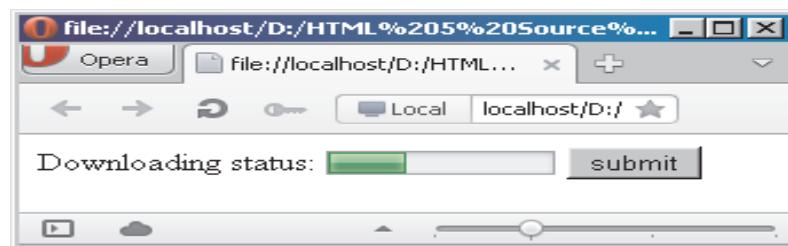


Figure 8.21: Progress Element in Opera

8.10 Hidden Elements

Sometimes, certain information in forms such as security tokens must be returned to the server on submission for scripts to function correctly. URL of the referring page may be collected along with the form submission. Such information does not have to be displayed to the user. This is where hidden fields come into picture. They are named so because they remain out of the sight of user when filling out a form. These fields can have a default value set by the developer or can be populated through JavaScript code. The information in hidden fields is processed by the server after the form is submitted.

Use of hidden fields also keeps forms concise. Following elaborates on the most common uses of a hidden field:

- **Tracks edited content, such as blogs:** Here, when a user edits a blog using a form, the ID of the record is used as a hidden input for the hidden field. When user submits the form, the server-side component knows from the ID the specific record that must be updated with submitted data.
- **Improves Website security:** Hidden inputs are invisible in the rendered page on the user's browser. Thus, if someone tries to view the source code at the user's side, they would not be able to see the hidden field content. Forms on banking Websites and other such sites are sensitive and include security measures. One such security measure is the use of security token to ensure that the right user is filling out the form. It also keeps malicious users away from pretending banks and sending out money transfer forms to unsuspected users.

8.10.1 Using Hidden Fields - An Example

Syntax # shows how to define a hidden field.

```
<input type="hidden">
```

Developers can edit the hidden value using developer tools.

Figure 8.22 shows an example form that a user would update.

Post title:	My latest trip to Bulgaria
Post content:	Hope You enjoy it!
<input type="button" value="Update post"/>	

Figure 8.22: Form for Content Update

Note that the form shows only text boxes for Post title and Post content respectively and a button called Update post.

Observe Code Snippet 32 that shows the HTML code for the form.

Code Snippet 32:

```
<div class="container">
<form>
    <div class="input-group">
        <label for="title">Post title:</label>
        <input type="text" id="title" name="title" value="My latest trip to
Bulgaria">
    </div>
    <div class="input-group">
        <label for="content">Post content:</label>
        <textarea id="content" name="content" cols="60" rows="5">
            Hope You enjoy it!
        </textarea>
    </div >
    <div class="input-group">
        <button type="submit">Update post</button>
    </div>
    <input type="hidden" id="postId" name="postId" value="23678">
</form>
</div>
```

Note the hidden input 23678 for the hidden field postId in code. The value is set by the developer before sending the form to the user. The hidden field is prefilled. When the user submits the information, the server would know the record it has to update.

Code Snippet 33 shows the CSS for the HTML form created in Code Snippet 32.

Code Snippet 33:

```
.container{
    display: flex;
    justify-content: center;
    align-items: center;
    height: 100vh;
}
.container form{
    padding: 50px;
    border-radius: 2px;
    border: 1px solid black;
}
.input-group{
    margin-bottom: 10px;
    display: flex;
}
input , textarea{
    flex: 6;
}
```

```
.container{  
label{  
    line-height: 2;  
    flex: 2;  
}  
textarea{  
    height: 60px;  
}
```

Following will be the data that would be sent to the server:

```
title=My+latest+trip+to+Bulgaria+post&content=+Hope+You+enjoy+it  
0D%0A++++&postId=23678
```

8.11 Data Attributes

Consider that you want to add some additional attributes to a song, such as genre, tempo, and duration so that users are able to perform a narrower search in the Website. HTML5 provides data attributes to do so. A data attribute helps store custom data or extra information on an HTML element. The data attributes can be called using JavaScript.

Following is the syntax to use data attribute:

```
<element data-<attribute_name>="value">
```

In the syntax, attribute_name indicates name of the attribute. data-product-type can be an example of a data attribute name.

8.12 Check Your Progress

1. Which tag is used to represents content that is tangentially related to the main text of a document?

(A)	<section>	(C)	<header>
(B)	<aside>	(D)	<article>

2. Match the following.

Value		Description	
(A)	static	(1)	The element is positioned relative to its normal position.
(B)	absolute	(2)	The element is positioned relative to the browser window.
(C)	fixed	(3)	The element is positioned relative to its first positioned.
(D)	relative	(4)	Elements renders in order, as they appear in the document flow. This is default.

(A)	a-2, b-1, c-3, d-4	(C)	a-4, b-3, c-2, d-1
(B)	a-1, b-2, c-3, d-4	(D)	a-3, b-2, c-4, d-1

3. Which tag is used to markup measurements or a scalar measurement within a known range?

(A)	<time>	(C)	<header>
(B)	<meter>	(D)	<progress>

4. Which of the following attribute displays a short hint or text inside a form element?

(A)	meter	(C)	caption
(B)	type	(D)	placeholder

5. Which of the following element is a data field that allows the user to edit the data on the form?

(A)	required	(C)	output
(B)	input	(D)	progress

6. The _____ element represents the current status of a task, which gradually changes as the task heads for completion.

(A)	datalist	(C)	progress
(B)	pattern	(D)	required

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7. Match the following.

Value		Description	
(A)	meter	(1)	Used for displaying the publication date and time
(B)	mark	(2)	Used with JavaScript for displaying the progress of a task
(C)	pubdate	(3)	Used for displaying fractional value
(D)	progress	(4)	Used for defining marked or highlighted text

(A)	a-3, b-4, c-1, d-2	(C)	a-4, b-3, c-2, d-1
(B)	a-1, b-2, c-3, d-4	(D)	a-2, b-1, c-4, d-3

8. Which of the following statements are true about Datalist?

(A)	Provides a text field with a set of predefined list of options that are displayed in a drop-down list
(B)	Is a form-specific element
(C)	<datalist> element is very similar to standard <select> element
(D)	Does not allow the user to enter data of their choice or select from the suggested list of options

9. Which of the following code disables the default behavior of autocomplete attribute?

(A)	E-mail: <input type="email" name="email" autocomplete="on" /> <input type="submit" value="submit" />
(B)	E-mail: <input type="email" name="email" autocomplete="yes" /> <input type="submit" value="submit" />
(C)	E-mail: <input type="email" name="email" /> <input type="submit" value="submit" />
(D)	E-mail: <input type="email" name="email" autocomplete="off" /><input type="submit" value="submit" />

10. Which of these are most common uses of a hidden field?

(A)	Track edited content, such as blogs	(C)	Improve Website security
(B)	Provide measurement	(D)	Aid in page navigation

8.12.1 Answers

1.	B
2.	C
3.	B
4.	D
5.	B
6.	C
7.	A
8.	A, B, C
9.	D
10.	A, C

Summary

- HTML5 has introduced two types of semantic tags. They are namely, text-level and structural. Some of the structural semantic tags include section, header, footer, and so on.
- Text-level semantic tags include mark, time, meter, and progress.
- Navigation is the most significant element in Web design. Since Web layouts does not have any physical representation, a user can depend on consistent navigation menu.
- Text-based navigation bars are created as stand-alone navigation bars that are not associated with icons. Text-based navigation bar is easy to create and can be displayed in any Web browsers.
- Graphical navigation bar is better than text-based navigation as it gives a visual appeal to the visiting users.
- Div can be used when there is no other semantically appropriate element left that suits the purpose in a Web page development.
- HTML5 introduces new form elements such as new input types, new attributes, browser-based validation, CSS3 styling techniques, and forms API.
- HTML5 provides new input types that are data-specific user interface elements such as email, url, number, range, date, tel, and color.
- The new form elements introduced in HTML5 are namely, datalist, progress, meter, and output.
- In HTML5, one can use the submit input type for form submission.
- Hidden elements remain out of the sight of user and can be used to transmit sensitive information to the server.
- A data attribute helps store custom data or extra information on an HTML element.

Try It Yourself

ABC Inc. is a gaming company which is planning to start its online site for games. ABC Inc. requires a navigation bar which will give information about their products, company itself, support, and online gaming center, and so on.

Navigation bar should have following links:

1. Home
2. About us
3. Products
4. Gaming Center
5. Support
6. Contacts

You as a Website designer have been assigned the task for developing the Website for the company using the new semantic tag.

2. Samson works for an advertising agency named Creative Designers which is headquartered at Hong Kong. He is very fond of learning latest technologies that are coming up in the market. He wants to create an HTML5 Website for his advertising agency. The Website should display the list of products for sale such as books, computers, vehicles, cameras, laptops, musical instruments, and so on. Only registered users can purchase products from the site. Help him to develop the application.



Session - 9

HTML5 Tables, Audio, and Video

Welcome to the Session, HTML5 Tables, Audio, and Video.

This session explores how to create tables, specify the size of the table, and the width of a column in a table. The session also describes the merging of table cells, how to define page layout for tables, and apply formatting to tables. This session describes the supported media types, audio, and video elements. It further describes the accessibility of audio elements, video elements, and how to deal with non-supporting browsers.

In this Session, you will learn to:

- ➔ Describe how to create and format tables
- ➔ Explain the table size and the width of a column
- ➔ Explain the process of merging table cells
- ➔ Explain the page layout for tables
- ➔ Describe the necessity for multimedia in HTML5
- ➔ List the supported media types in HTML5
- ➔ Explain the audio elements in HTML5
- ➔ Explain the video elements in HTML5
- ➔ Explain the accessibility of audio and video elements
- ➔ Describe how to deal with non-supporting browsers

9.1 Introduction

Tables allow the user to view the data in a structured and classified format. Tables can contain any type of data such as text, images, links, and other tables. The user can create tables for displaying timetables, financial reports, and so on.

9.2 Creating and Formatting Tables

A table is made up of rows and columns. The intersection of each row and column is called as a cell. A row is made up of a set of cells that are placed horizontally. A column is made up of set of cells that are placed vertically.

The user can represent the data in a tabular format by using the `<table>` element in HTML. The `<tr>` element divides the table into rows and the `<td>` element specifies columns for each row. By default, a table does not have a border. The `border` attribute of the `<table>` element specifies a border for making the table visible in a Web page.

Code Snippet 1 demonstrates how to create a table.

Code Snippet 1:

```
<!DOCTYPE HTML>
<html>
  <head>
    <title>Languages</title>
  </head>
  <body>
    <h2>Main Languages</h2>
    <table border="1">
      <tr>
        <td>English</td>
        <td>German</td>
      </tr>
      <tr>
        <td>French</td>
        <td>Italian</td>
      </tr>
    </table>
  </body>
</html>
```

The code uses the `<table>` element to create a table. The `border` attribute of `<table>` element gives a border to the table, which is one pixel wide. The `<tr>` element within the `<table>` element creates rows. The `<td>` element creates two cells with the values English and German in the first row and French and Italian in the second row.

Figure 9.1 displays a table created.

The screenshot shows a web browser window with a blue title bar labeled 'Languages'. Below the title bar is a toolbar with standard icons for back, forward, search, and file operations. The main content area has a heading 'Main Languages' in bold. Below the heading is a 2x2 grid of four cells, each containing a language name: 'English' (top-left), 'German' (top-right), 'French' (bottom-left), and 'Italian' (bottom-right). The entire grid is enclosed in a thin border.

Figure 9.1: Table Created

9.2.1 Table Headings

The user can specify the heading for each column in HTML. To specify the heading for columns in a table, use the `<th>` element.

The text included within the `<th>` element appears in bold. Code Snippet 2 demonstrates how to create a table with a heading.

Code Snippet 2:

```
<!DOCTYPE HTML>
<html>
  <head>
    <title>List of Students </title>
  </head>
  <body>
    <h2>List of Students</h2>
    <table border="1">
      <tr>
        <th>Name</th>
        <th>Age</th>
        <th>Place</th>
      </tr>
      <tr>
        <td>Mark</td>
        <td>17</td>
        <td>Madrid</td>
      </tr>
      <tr>
        <td>John</td>
```

```
<td>19</td>
<td>London</td>
</tr>
</table>
</body>
</html>
```

In this code, the `<table>` element creates a table with a border of one pixel. The `<th>` element provides three column headings namely, **Name**, **Age**, and **Place**. The second and the third row lists the details of the students in the three columns.

Figure 9.2 displays the output of the table with headings.

Name	Age	Place
Mark	17	Madrid
John	19	London

Figure 9.2: Table with Headings

9.2.2 Colspan Attribute

The user might feel the necessity to span two or more cells while working with tables. Spanning refers to a process of extending a cell across multiple rows or columns. To span two or more columns, use the `colspan` attribute of the `<td>` and `<th>` elements.

The `colspan` attribute allows the user to span a cell along a horizontal row. The value of the `colspan` attribute specifies the number of cells across which a specific cell shall be expanded. Code Snippet 3 demonstrates how to create a table and span header cells across two cells vertically.

Code Snippet 3:

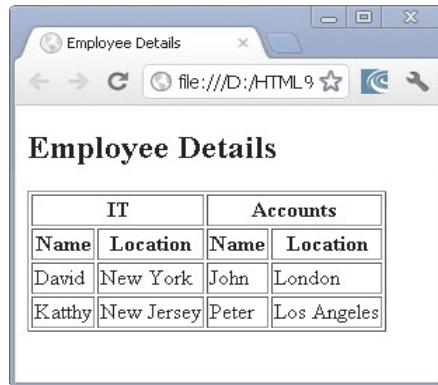
```
<!DOCTYPE HTML>
<html>
  <head>
    <title>Employee Details</title>
  </head>
  <body>
    <h2>Employee Details</h2>
```

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```
<table border="1">
  <tr>
    <th colspan="2">IT</th>
    <th colspan="2">Accounts</th>
  </tr>
  <tr>
    <th>Name</th>
    <th>Location</th>
    <th>Name</th>
    <th>Location</th>
  </tr>
  <tr>
    <td>David</td>
    <td>New York</td>
    <td>John</td>
    <td>London</td>
  </tr>
  <tr>
    <td>Kathy</td>
    <td>New Jersey</td>
    <td>Peter</td>
    <td>Los Angeles</td>
  </tr>
</table>
</body>
</html>
```

The code creates a table with a border of one pixel. The `<th>` element specifies two column headings namely, **IT** and **Accounts**. Each of these header cells horizontally span across the two cells by setting the `colspan` attribute of the `<th>` element to **2**. Each of these headings has two sub-headings namely, Name and Location, which specify the **name** and **location** of employees. The first and second rows display the details of the employees.

Figure 9.3 displays the employee details.



IT		Accounts	
Name	Location	Name	Location
David	New York	John	London
Kathy	New Jersey	Peter	Los Angeles

Figure 9.3: Employee Details

9.2.3 Rowspan Attribute

The `rowspan` attribute spans a data cell across two or more rows. It allows the user to span a data cell along a vertical column. Like the `colspan` attribute, the `rowspan` attribute can be used within the `<td>` and `<th>` elements. Code Snippet 4 demonstrates how to span a cell across multiple rows.

Code Snippet 4:

```
<!DOCTYPE HTML>
<html>
  <head>
    <title>Automobile Gallery</title>
  </head>
  <body>
    <table border="1">
      <tr>
        <th>Manufacturer</th>
        <th>Model</th>
        <th>Price</th>
      </tr>
      <tr>
        <th rowspan="3">Audi</th>
        <td>A4</td>
        <td>34.5</td>
      </tr>
      <tr>
        <td>A5</td>
        <td>42.6</td>
      </tr>
    </table>
  </body>
</html>
```

```
<tr>
  <td>A6</td>
  <td>30.75</td>
</tr>
<tr>
  <th rowspan="2">BMW</th>
  <td>328i</td>
  <td>28.25</td>
</tr>
<tr>
  <td>530d</td>
  <td>47.5</td>
</tr>
</table>
</body>
</html>
```

The code creates a table with a border width of one pixel. The three `<th>` elements within the `<tr>` element specify column headings namely, **Manufacturer**, **Model**, and **Price**. The `rowspan` attribute of the `<th>` element combines the three rows of the **Manufacturer** column into a common brand namely **Audi**. The three different models and the respective prices of the **Audi** brand are displayed in three different rows. Similarly, the `rowspan` attribute of the `<th>` element combines the next two rows of the **Manufacturer** column into a common brand called **BMW**.

Figure 9.4 displays the `rowspan` attribute effect.

A screenshot of a web browser window titled "Automobile Gallery". The address bar shows "file:///D:/HTML". The browser displays a table with three columns: "Manufacturer", "Model", and "Price". The "Manufacturer" column uses the `rowspan` attribute to group rows for "Audi" and "BMW". The "Audi" group spans three rows, containing "A4", "A5", and "A6". The "BMW" group spans two rows, containing "328i" and "530d". The "Model" and "Price" columns are standard, aligned to the left. An arrow points from the text "Effect of rowspan" at the bottom to the "BMW" row.

Manufacturer	Model	Price
Audi	A4	34.5
	A5	42.6
	A6	30.75
BMW	328i	28.25
	530d	47.5

Figure 9.4: rowspan Attribute Effect

9.2.4 Horizontal Alignment

Alignment determines the representation of text along the left, right, or center positions. In HTML, by default, the data within the table is aligned on the left of the cell. Sometimes, the user might require to

align the data to some other position for improving the readability or focusing on some data. HTML5 has deprecated the align attribute.

The four possible values for setting the horizontal alignment are as follows:

- **left**
Aligns the data within a cell on the left. This is the default value for table content.
- **center**
Aligns the data within the cell on the center. This is the default value for table headings.
- **right**
Aligns the data within the cell on the right.
- **justify**
Aligns the data within the cell by adjusting the text at the edges.

To set the alignment with style you can use the text-align attribute to specify the horizontal alignment.

Code Snippet 5 demonstrates how to center align the table data.

Code Snippet 5:

```
<!DOCTYPE HTML>
<html>
  <head>
    <title>Automobile Gallery</title>
  </head>
  <body>
    <table border="1">
      <tr>
        <th>Sr.No.</th>
        <th>Medicine Name</th>
        <th>Price</th>
      </tr>
      <tr style="text-align: center;">
        <td>1</td>
        <td>Captopril</td>
        <td>12.45</td>
      </tr>
      <tr style="text-align: center;">
        <td>2</td>
        <td>Ceftriaxone</td>
        <td>6.94</td>
      </tr>
    </table>
  </body>
</html>
```

```
</tr>
<tr style="text-align: center;">
<td>3</td>
<td>Ciprofloxacin</td>
<td>56.21</td>
</tr>
</table>
</body>
</html>
```

The code aligns the data within the row using a style within the `<tr>` element. The table content is center aligned by setting the value of the `text-align` attribute to `center`.

Figure 9.5 displays the horizontal alignment.

Sr.No.	Medicine Name	Price
1	Captopril	12.45
2	Ceftriaxone	6.94
3	Ciprofloxacin	56.21

Figure 9.5: Horizontal Alignment

9.2.5 Vertical Alignment

Users can vertically align the position of data earlier by using the `vAlign` attribute. HTML5 has deprecated the `vAlign` attribute. The possible values of vertical alignment are as follows:

→ **top**

Vertically aligns the data within the cell at the top.

→ **middle**

Vertically aligns the data within the cell at the center.

→ **bottom**

Vertically aligns the data within the cell at the bottom.

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To set the alignment with the style you can use the `text-align` attribute to specify the vertical alignment use following syntax:

Syntax:

```
<td style= "text-align: center; vertical-align: middle">
```

The style can also be applied to individual rows, cells, or to the entire table.

Code Snippet 6 demonstrates how to align the data vertically within the table using the `style` attribute.

Code Snippet 6:

```
<!DOCTYPE HTML>
<html>
  <head>
    <title>CelinaBatteries</title>
  </head>
  <body>
    <table border="1">
      <tr>
        <th>Sr.No.</th>
        <th>Product Id</th>
        <th>Product Description</th>
      </tr>
      <tr>
        <td style="text-align: center; vertical-align: middle">1
        </td>
        <td style="text-align: center; vertical-align: middle">P101
        </td>
        <td>1.5 Volts AA Ultra Alkaline</td>
      </tr>
      <tr>
        <td style="text-align: center; vertical-align: middle">2
        </td>
        <td style="text-align: center; vertical-align: middle">M105
        </td>
        <td>9 Volts pp3 Super Alkaline</td>
      </tr>
    </table>
  </body>
</html>
```

The `text-align` attribute is set to the value `center`, which specifies that the data within the rows are centrally aligned. The `vertical-align` is used to specify the vertical alignment in the table. Figure 9.6 displays the vertical alignment.

A screenshot of a web browser window titled "CelinaBatteries". The address bar shows "file:///D:/HTML". The browser interface includes standard controls like back, forward, and search. Below the header is a table with three columns: "Sr.No.", "Product ID", and "Product Description". There are two rows of data. An arrow points from the caption "Effect of vertical alignment" to the second row's "Product Description" cell, which contains the text "9 Volts PP3 Super Alkaline".

Sr.No.	Product ID	Product Description
1	P101	1.5 Volts AA Ultra Alkaline
2	M105	9 Volts PP3 Super Alkaline

Effect of vertical alignment

Figure 9.6: Vertical Alignment

9.2.6 Margin Attributes

The data in a table might appear cluttered, which may affect the readability. This might make it difficult to comprehend data as the data. To overcome this issue, use the cell margin attributes.

Cell padding allows the user to control the look of the content on a page.

- **Padding:** Padding is the amount of space between the content and its outer edge. For tables, padding is specified as a space between the text and the cell border.

Suppose if the user wants to set the `padding` attribute for the individual cells then, he/she can use the `padding` attribute in a style as follows:

```
<td style="padding: 4px">
```

9.2.7 Caption Element

The user can add a heading to a table in HTML. To specify the main heading for the table, use the `<caption>` element. The `<caption>` element defines a caption for the table. It is a sub-element of the `<table>` element. It must be present immediately after the `<table>` tag.

Unlike the `<th>` element that is used to specify a heading to an individual row or column, the `<caption>` element allows the user to specify a title for your entire table. There can be only one caption for a table.

Code Snippet 7 demonstrates how to specify a heading for a table.

Code Snippet 7:

```
<!DOCTYPE HTML>
<html>
  <head>
    <title>Travel Expense Report</title>
  </head>
  <body>
    <table border="1">
      <caption>Travel Expense Report</caption>
      <tr>
        <th>&nbsp;</th>
        <th>Meals</th>
        <th>Hotels</th>
        <th>Transport</th>
      </tr>
      <tr>
        <td>25-Apr</td>
        <td>37.74</td>
        <td>112.00</td>
        <td>45.00</td>
      </tr>
      <tr>
        <td>26-Apr</td>
        <td>27.28</td>
        <td>112.00</td>
        <td>45.00</td>
      </tr>
      <tr>
        <td>Totals</td>
        <td>65.02</td>
        <td>224.00</td>
        <td>90.00</td>
      </tr>
    </table>
  </body>
</html>
```

The code creates a table of border width of one pixel. The `<caption>` element that is used inside the `<table>` element specifies a caption to the entire table as Travel Expense Report.

Figure 9.7 displays the table captions.

A screenshot of a web browser window titled "Travel Expense Report". The browser interface includes standard controls like back, forward, and search. The main content area shows a table with the following data:

	Meals	Hotels	Transport
25-Apr	37.74	112.00	45.00
26-Apr	27.28	112.00	45.00
Totals	65.02	224.00	90.00

Figure 9.7: Table Captions

9.3 Table Size and Width of a Column

The user can decide the size of the table based on his/her requirements while creating a Website. The table size can be expanded when the user wants to add rows and columns in the table. The user can use the `<style>` section to set the default width for the table to 100% of the browser window.

For setting the width of a column in pixels, you can use style attribute in the `<td>` tag.

Code Snippet 8 demonstrates how to create a table with specific width for a column.

Code Snippet 8:

```
<!DOCTYPE HTML>
<html>
  <head>
    <title>Tables</title>
  </head>
  <body>
    <h2>Table</h2>
    <table border="1">
      <tr>
        <td style ="width: 200px">Flowers</td>
        <td style ="width: 80px">Fruits</td>
      </tr>
      <tr>
        <td style ="width: 200px">Vegetables</td>
        <td style ="width: 80px">Trees</td>
      </tr>
    </table>
  </body>
</html>
```

```
</tr>
</table>
</body>
</html>
```

The code creates a table of border width of one pixel. The `<style>` element is used to set table width to 100%. The width of the columns is set by using the `style` attribute. Figure 9.8 displays the table size and column width.



Figure 9.8: Table Size and Column Width

9.4 Merging Table Cells

Suppose if the user wants to change the cells of a table to different height and width then, `colspan` and `rowspan` attributes can be used. Consider a scenario, where the user wants to merge a cell into adjacent cells to the right-hand side. The `colspan` attribute can be used to specify the number of columns to span. Similarly, the user can use the `rowspan` attribute to specify the number of rows.

Code Snippet 9 demonstrates creating a table having five columns and five rows, but many of the cells span multiple columns or rows.

Code Snippet 9:

```
<!DOCTYPE HTML >
<html>
<head>
<title>Favorite Destination</title>
</head>
<body>
<h2>Report</h2>
<table border="1" width="100%" height="100%">
<tr>
<td colspan="2" rowspan="2">Results</td>
<td colspan="3">Range</td>
</tr>
<tr>
<td>18 to 20</td>
<td>21 to 30</td>
<td>31 to 40</td>
<td>41 to 50</td>
</tr>
<tr>
<td>51 to 60</td>
<td>61 to 70</td>
<td>71 to 80</td>
<td>81 to 90</td>
<td>91 to 100</td>
</tr>
<tr>
<td>101 to 110</td>
<td>111 to 120</td>
<td>121 to 130</td>
<td>131 to 140</td>
<td>141 to 150</td>
</tr>
<tr>
<td>151 to 160</td>
<td>161 to 170</td>
<td>171 to 180</td>
<td>181 to 190</td>
<td>191 to 200</td>
</tr>
<tr>
<td>201 to 210</td>
<td>211 to 220</td>
<td>221 to 230</td>
<td>231 to 240</td>
<td>241 to 250</td>
</tr>
<tr>
<td>251 to 260</td>
<td>261 to 270</td>
<td>271 to 280</td>
<td>281 to 290</td>
<td>291 to 300</td>
</tr>
<tr>
<td>301 to 310</td>
<td>311 to 320</td>
<td>321 to 330</td>
<td>331 to 340</td>
<td>341 to 350</td>
</tr>
<tr>
<td>351 to 360</td>
<td>361 to 370</td>
<td>371 to 380</td>
<td>381 to 390</td>
<td>391 to 400</td>
</tr>
<tr>
<td>401 to 410</td>
<td>411 to 420</td>
<td>421 to 430</td>
<td>431 to 440</td>
<td>441 to 450</td>
</tr>
<tr>
<td>451 to 460</td>
<td>461 to 470</td>
<td>471 to 480</td>
<td>481 to 490</td>
<td>491 to 500</td>
</tr>
<tr>
<td>501 to 510</td>
<td>511 to 520</td>
<td>521 to 530</td>
<td>531 to 540</td>
<td>541 to 550</td>
</tr>
<tr>
<td>551 to 560</td>
<td>561 to 570</td>
<td>571 to 580</td>
<td>581 to 590</td>
<td>591 to 600</td>
</tr>
<tr>
<td>601 to 610</td>
<td>611 to 620</td>
<td>621 to 630</td>
<td>631 to 640</td>
<td>641 to 650</td>
</tr>
<tr>
<td>651 to 660</td>
<td>661 to 670</td>
<td>671 to 680</td>
<td>681 to 690</td>
<td>691 to 700</td>
</tr>
<tr>
<td>701 to 710</td>
<td>711 to 720</td>
<td>721 to 730</td>
<td>731 to 740</td>
<td>741 to 750</td>
</tr>
<tr>
<td>751 to 760</td>
<td>761 to 770</td>
<td>771 to 780</td>
<td>781 to 790</td>
<td>791 to 800</td>
</tr>
<tr>
<td>801 to 810</td>
<td>811 to 820</td>
<td>821 to 830</td>
<td>831 to 840</td>
<td>841 to 850</td>
</tr>
<tr>
<td>851 to 860</td>
<td>861 to 870</td>
<td>871 to 880</td>
<td>881 to 890</td>
<td>891 to 900</td>
</tr>
<tr>
<td>901 to 910</td>
<td>911 to 920</td>
<td>921 to 930</td>
<td>931 to 940</td>
<td>941 to 950</td>
</tr>
<tr>
<td>951 to 960</td>
<td>961 to 970</td>
<td>971 to 980</td>
<td>981 to 990</td>
<td>991 to 1000</td>
</tr>
</table>
</body>
</html>
```

```
<td>25 to 50</td>
<td>over 50</td>
</tr>
<tr>
    <td rowspan="3">Your favorite vacation destination</td>
    <td>Dubai</td>
    <td>25%</td>
    <td>50%</td>
    <td>25%</td>
</tr>
<tr>
    <td>Bangkok</td>
    <td>40%</td>
    <td>30%</td>
    <td>30%</td>
</tr>
<tr>
    <td>Switzerland</td>
    <td>30%</td>
    <td>20%</td>
    <td>50%</td>
</tr>
</table>
</body>
</html>
```

The code creates a table having a border of one pixel. It also creates a table with five columns and five rows and uses the `colspan` and `rowspan` attributes respectively.

Figure 9.9 displays the merging table cells.

A screenshot of a web browser window titled "Favorite Destination". The main content area is titled "Report". It displays two tables. The first table has a single row with three cells: "Results" (colspan=2) and "Range" (colspan=2). The "Range" row contains three cells: "18 to 20", "25 to 50", and "Over 50". The second table has four rows. The first row contains three cells: "Your favorite vacation destination" (colspan=2), "Dubai", and "25%". The second row contains three cells: "Bangkok", "40%", and "30%". The third row contains three cells: "Switzerland", "30%", and "20%". The fourth row contains three cells: " ", " ", and "50%".

Results	Range		
	18 to 20	25 to 50	Over 50
Your favorite vacation destination		Dubai	25%
		Bangkok	40%
		Switzerland	30%
			20%
			50%

Figure 9.9: Merging Table Cells

9.5 Apply Borders by Using Styles

Users can use CSS for applying borders as it is the best reliable and flexible method. The user must select the CSS method for Websites that will be active for many years as the old formatting methods will not be used in future. You can format the table by using style based border for `<table>` and `<td>` tags. To evaluate the attributes used are as follows:

- The `border-width` attribute is used to control the thickness of the border and the values are specified in pixels.
- The `border-color` attribute is used to control the color of the border and specifies the color by either name, or RGB value, or hexadecimal number.
- The `border-style` attribute is used to control the line style. Users can choose between solid, dashed, groove, dotted, outset, ridge, inset, or none.

Suppose if the user wants to set all these attributes at one time then, the user can use the `border` attribute and place the settings in following order namely, `width`, `color`, and `style` respectively. The user can also format the sides of the border individually by replacing the `border` attribute with `border-bottom`, `border-top`, `border-right`, or `border-left` attribute. The user can apply these attributes to the entire table or individual cells and also create rules in the `<style>` area.

9.6 Tables for Page Layout

Nowadays, there are many new techniques used for developing attractive Web pages. Tables are used for structuring the content. In other words, tables are used by the user to organize the data in an appropriate manner.

With tables the user can arrange the data horizontally or vertically according to his/her requirements. Community Websites such as Facebook has different page layouts, the user uses the navigation tabs to move from one page to another. Similarly, the look and feel of each page is different.

While accessing Websites such as Yahoo, Rediff, and so on users can view that the home page is very informative with a number of links, images, and so on. Each Website has their unique way of presenting data to their customers or users. Many Websites use pop-ups for providing information to their customers.

Code Snippet 10 demonstrates a simple example of using table for structuring the content of a Web page.

Code Snippet 10:

```
<!DOCTYPE HTML>
<html>
<head>
    <title>Page Layout </title>
</head>
<style>
    #navlayout {
```

```
width: 100%;  
float: left;  
margin: 0 0 3em 0;  
padding: 0;  
list-style: none;  
background-color: #f2f2f2;  
border-bottom: 1px solid #ccc;  
border-top: 1px solid #ccc; }  
  
#navlayout li {  
    float: left; }  
  
#navlayout li a {  
    display: block;  
    padding: 8px 15px;  
    text-decoration: none;  
    font-weight: bold;  
    color: #069;  
    border-right: 1px solid #ccc; }  
  
#navlayout li a:hover {  
    color: #c00;  
    background-color: #fff; }  
  
</style>  
  
<body>  
      
    <h1>Blossoms Gallery</h1>  
    <h5><i>The Best sellers for flowers since 1979</i></h5>  
    <navlayout>  
        <hr>  
        <ul id="navlayout">  
            <li><a href="#">Home</a></li>  
            <li><a href="#">Contact Us</a></li>  
            <li><a href="#">About Us</a></li>  
            <li><a href="#"> FAQs</a></li>  
        </ul>  
        <table>  
            <tr>  
                <td>
```

```
<b>Flowers are now in stock! </b>
</navlayout>
<i>We have just received a large shipment of flowers with prices as low as $19.
</i>
</td>
</tr>
</table>
</body>
</html>
```

The code creates a page layout for a Website. The data is arranged in a tabular format and an embedded style is used for defining the style. The style is defined using the `style` element placed immediately after the `<head>` section.

Defining a style in this manner helps to reuse the style in the same Web page.

The style is set using the ID selector methodology and is identified as `navlayout`. This will enable to apply the style to the content of all those elements whose `id` attribute has been set to `navlayout`.

Figure 9.10 displays the example of a page layout for using tables.

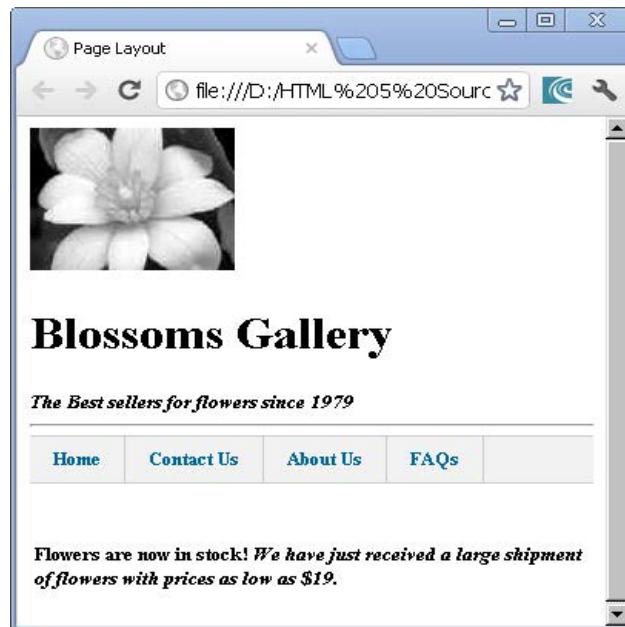


Figure 9.10: Page Layout for Tables

9.7 Introduction

Traditionally, Web browsers were capable of handling only graphics and text. Suppose, if a user had to play some video, then, a distinct program, plug-in, or an ActiveX control had to be installed. Earlier, Web designers and Web developers used to set up Web pages to play audio and video on the Web using Adobe Flash player.

9.8 Multimedia in HTML5

Multimedia is a combination of various elements such as video, graphics, sound, and text. A common way of inserting a multimedia content on Web pages is by embedding a video or audio file in the Web page.

Consider the earlier situations where a Website developer did not have the facility of including videos or audios directly on their Website until and unless the browser had the required plug-in installed. These days, Website developers want their visitors to not only download, but also, view movies online on their Website. This is possible by adding the new features of HTML5 which can provide this facility.

HTML5 has made lives easier by introducing `<audio>` and `<video>` elements. In other words, HTML5 has provided the developers with the features to embed media on the Web pages in a standard manner. Thus, the user does not have to depend on Flash to access the audio and video files.

9.9 Supported Media Types in Audio and Video

There are various video and audio codecs which are used for handling of video and audio files. The codec is a device or a program used for encoding and decoding digital data stream. These different codecs have different level of compression quality.

For storing and transmitting coded video and audio together, a container format is used. There are a number of container formats which includes Ogg (.ogg), the Audio Video Interleave (.avi), Flash Video (.flv), and many others. WebM is a new open source video container format supported by Google. Different browsers support different container format.

Table 9.1 lists the common audio and video formats.

Container	Video Codec	Audio Codec
Mp4	H.264	AAC
Ogg	Theora	Vorbis
WebM	VP8	Vorbis

Table 9.1: Common Audio and Video Formats

9.9.1 Audio Formats

There are three supported file formats for the `<audio>` element in HTML5. Table 9.2 lists the audio file formats supported by the Web browsers.

Browsers Support	MP3	Wav	Ogg
Opera 10.6 onwards	No	Yes	Yes
Apple Safari 5 onwards	Yes	Yes	No
Google Chrome 6 onwards	Yes	Yes	Yes
FireFox 4.0 onwards	No	Yes	Yes
Internet Explorer 9	Yes	No	No

Browsers Support	MP3	Wav	Ogg
Edge 17-91 and 92 onwards	Yes	Yes	Yes

Table 9.2: Audio File Formats Supported by the Web Browsers

9.9.2 Video Formats

There are three supported file formats for the <video> element in HTML5. Table 9.3 lists the video file formats supported by the Web browsers.

Browsers Support	MP4	WebM	Ogg
Opera 10.6 onwards	No	Yes	Yes
Apple Safari 5 onwards	Yes	No	No
Google Chrome 6 onwards	Yes	Yes	Yes
FireFox 4.0 onwards	No	Yes	Yes
Internet Explorer 9 onwards	Yes	No	No
Edge 79 onwards	Yes	Yes	Yes

Table 9.3: Video File Formats Supported by the Web Browsers

9.10 Audio Elements in HTML5

The <audio> element will help the developer to embed music on the Website and allow the user to listen to music. The <audio> element is one of the best features in HTML5. This feature allows the user to enable a native audio file within the Web browser. The <audio> tag specifies the audio file to be used in the HTML document. The `src` attribute is used to link to the audio file.

Code Snippet 11 displays the embedding of an audio file in the Web page using the <audio> tag. The music is played in the background when the page is loaded on the browser.

Code Snippet 11:

```
<!DOCTYPE html>
<html>
<head>
    <title>audio element</title>
</head>
<body>
    <audio src="d:\sourcecodes\audio.mp3"
        controls autoplay loop>
        html5 audio not supported
    </audio>
</body>
</html>
```

The `src` attribute is mandatory, the `<audio>` tag includes several other options. Figure 9.11 displays the `<audio>` element.

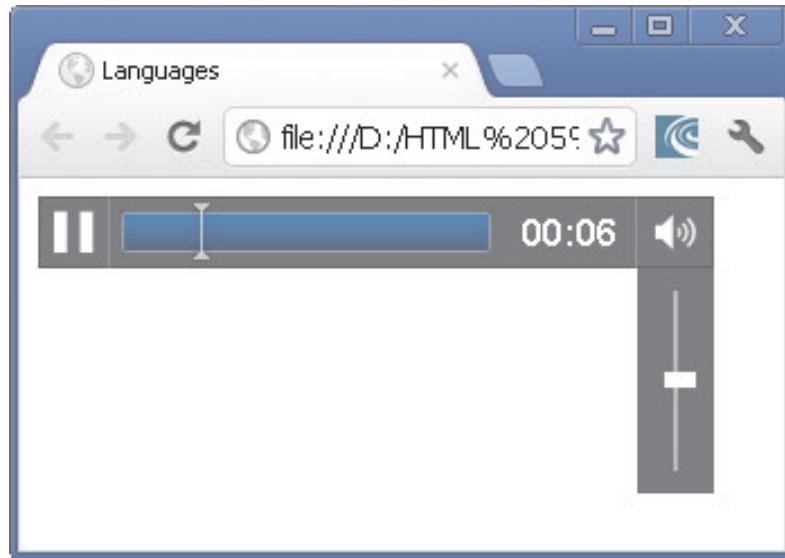


Figure 9.11: `<audio>` Element

The existing HTML5 specification does not specify the formats supported by the browser in the `<audio>` tag. The audio formats frequently used are **wav**, **ogg**, and **mp3**.

The users can also use the `<source>` tag to specify the media along with the media type and other attributes. An audio element can contain multiple source elements and the browser will identify the first supported format.

9.10.1 Audio Tag Attributes

HTML tags normally consist of more than one attribute. Attributes provide additional information to the browser about the tag. HTML5 has a number of attributes for controlling the look and feel of various functionalities. According to HTML5 specifications, the `<audio>` element has following attributes. Table 9.4 lists the `<audio>` tag attributes.

Audio Attributes	Description
<code>autoplay</code>	This attribute identifies whether to start the audio or not once the object is loaded. The attribute accepts a boolean value which when specified will automatically start playing the audio as soon as possible without stopping
<code>autobuffer</code>	This attribute starts the buffering automatically
<code>controls</code>	This attribute identifies the audio playback controls that should be displayed such as resume, pause, play, and volume buttons
<code>loop</code>	This attribute identifies whether to replay the audio once it has stopped
<code>preload</code>	This attribute identifies whether the audio has to be loaded when the page loads and is ready to execute. This preload attribute is ignored if autoplay exists

Audio Attributes	Description
src	This attribute specifies the location or the URL of the audio file that has to be embedded

Table 9.4: <audio> Tag Attributes

9.10.2 Creating Audio Files

Suppose, if the user plays the audio in older browsers then the <embed> tag will be used. The <embed> tag has two attributes, `src` and `autoplay`. The `src` attribute is used to specify the source of the audio and the `autoplay` attribute controls the audio and determines whether the audio should play as soon as the page loads.

Code Snippet 12 demonstrates the use of <embed> tag in the <audio> element.

Code Snippet 12:

```
<!DOCTYPE HTML>

<html>
<body>

    <audio autoplay loop>

        <source src="sampaudio.mp3">
        <source src="sampaudio.ogg">
        <embed src="sampaudio.mp3">

    </audio>
</body>
</html>
```

The <audio> element in HTML5 supports multiple formats. The content included within the <embed> tag is automatically played by default. Suppose, if the user does not want to play the audio file automatically then, he/she can set the value of the `autoplay` attribute to "false".

Code Snippet 13 demonstrates the use of the `autoplay` attribute.

Code Snippet 13:

```
<embed src="mpaudio.mp3" autoplay="false" >
```

The <embed> tag also supports another attribute named `loop`. The `loop` attribute determines whether the audio clip will be replayed continuously or not. If the value of the `loop` attribute is set to `true` or `infinite` then, the music will be played continuously. If the `loop` attribute is not specified then, it is same as setting the value to `false`.

Code Snippet 14 demonstrates the use of some of the audio formats supported by HTML5.

Code Snippet 14:

```
<!DOCTYPE HTML>

<html>
<body>

    <audio controls autoplay>
        <source src="/html5/sampaudio.ogg" type="audio/ogg" />
        <source src="/html5/sampaudio.wav" type="audio/wav" />
        Your browser does not support the <audio> element.
    </audio>
</body>
</html>
```

Code Snippet 14 shows the **ogg** and **wav** formats supported by the `<audio>` tag. While adding the `<audio>` element in the code, the user can specify error messages to check if the browser is supporting the `<audio>` tag or not.

9.11 Video Elements in HTML5

The `<video>` element is a new feature added in HTML5. The user can use the `<video>` element for embedding the video content on the Web page. The easiest way to specify the video is by using the `src` attribute which give the URL of the video file to be used. Suppose, if the browser does not support the `<video>` element then, the content between the start tag and end tag is displayed on the browser.

Code Snippet 15 demonstrates the use of the `<video>` element.

Code Snippet 15:

```
<!DOCTYPE HTML>

<html>
<head>
</head>
<body>

    <video src="D:\\Source codes\\movie.mp4">
        Your browser does not support the video.
    </video>
</body>
</html>
```

In the code, the `src` attribute is used for specifying the location of the mp4 video file format used by the

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<video> tag. While adding the <video> element in the code, the user can specify messages between the <video> and </video> tag to check if the browser is supporting the <video> tag or not.

Figure 9.12 displays the <video> element.

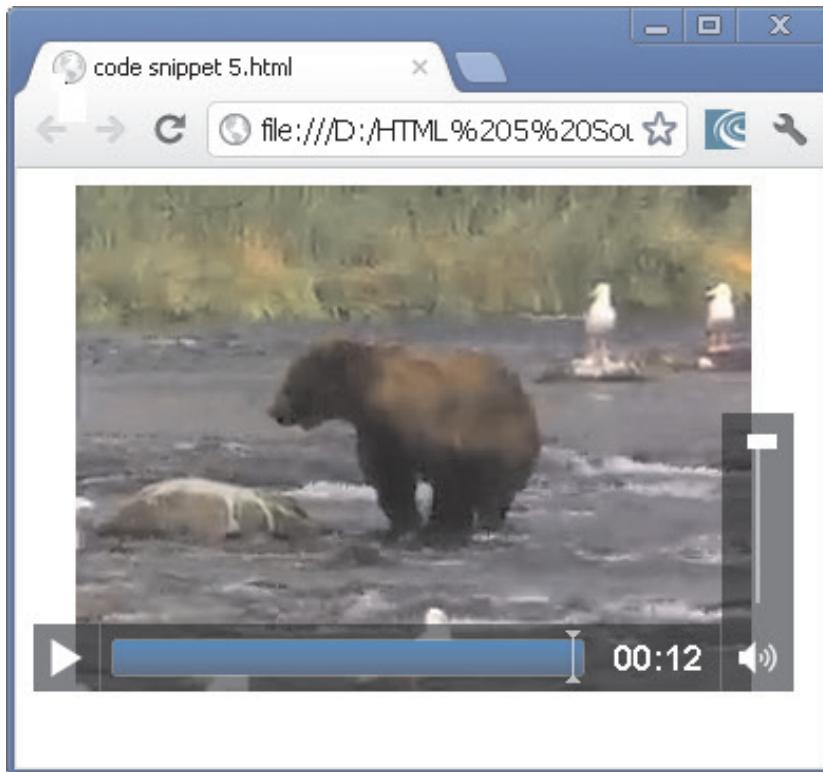


Figure 9.12: <video> Element

9.11.1 Video Tag Attributes

The HTML5 specification provides a list of attributes that can be used with the <video> element. Table 9.5 lists the <video> tag attributes.

Video Attributes	Description
autoplay	Specifies that the browser will start playing the video as soon as it is ready
muted	Allows to mute the video initially, if this attribute is existing
controls	Allows displaying the controls of the video, if the attribute exists
loop	Specifies that the browser should repeat playing the existing video once more if the loop attribute exists and accepts a boolean value
preload	Specifies whether the video should be loaded or not when the page is loaded
src	Specifies the location of the video file to be embedded

Table 9.5: <video> Tag Attributes

Note - The muted attribute is not supported in Safari and Internet Explorer.

9.11.2 Preloading the Video

The <video> element comprises a `preload` attribute that allows the browser to download or buffer the video while the Web page containing the video is being downloaded. If the video is preloaded, then it decreases the initial delay once the user has started the playback. The `preload` attribute has following values:

→ **None**

This attribute allows the browser to load only the page. The video will not be downloaded while the page is being loaded.

→ **Metadata**

This attribute allows the browser to load the metadata when the page is being loaded.

→ **Auto**

This is the default behavior as it allows the browser to download the video when the page is loaded. The browser can avoid the request.

Code Snippet 16 demonstrates the use of `none` and `metadata` values for the `preload` attribute.

Code Snippet 16:

```
<!DOCTYPE HTML>
<html>
  <head>
  </head>
  <body>
    <video width="160" height="140" src="D:\Source Codes\movie.mp4"
      controls preload="none" muted>
      Your browser does not support the video.
    </video>
    <video width="160" height="140" src="D:\ Source Codes\movie.mp4"
      controls preload="metadata" muted>
      Your browser does not support the video.
    </video>
  </body>
</html>
```

In the code, the `preload` attribute specifies `none` and `metadata` values.

Figure 9.13 displays the effect of none and metadata values.

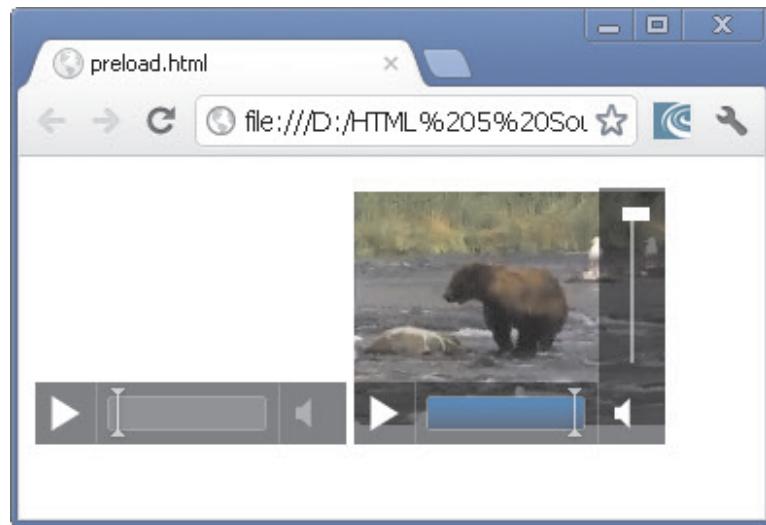


Figure 9.13: Effect of none and metadata Values

9.11.3 Setting the Video Size

The user can specify the size of the video with the `height` and `width` attribute of the `<video>` element. Suppose, if these attributes are not provided then, the browser sets the video with the key dimensions of the video. This will result in changing the page layout as the Web page is adjusted to accommodate the video.

Code Snippet 17 demonstrates how to apply the `height` and `width` attributes to the `<video>` element.

Code Snippet 17:

```
<!DOCTYPE HTML>
<html>
  <head>
    </head>
  <title> Video Size</title>
  <style>
    video{
      background-color: black;
      border: medium double black;
    }  </style>
  <body>
    <video src="D:\Source Codes\movie.mp4"
           controls preload="auto" width="360" height="340">
      Your browser does not support the video.
    </video>
```

```
</body>  
</html>
```

In the code, the `style` attribute is used to specify the `background-color` and `border style` of the video. The code also specifies the `preload`, `height`, and `width` attributes for the `<video>` element.

Figure 9.14 displays the width, height, and style effect.

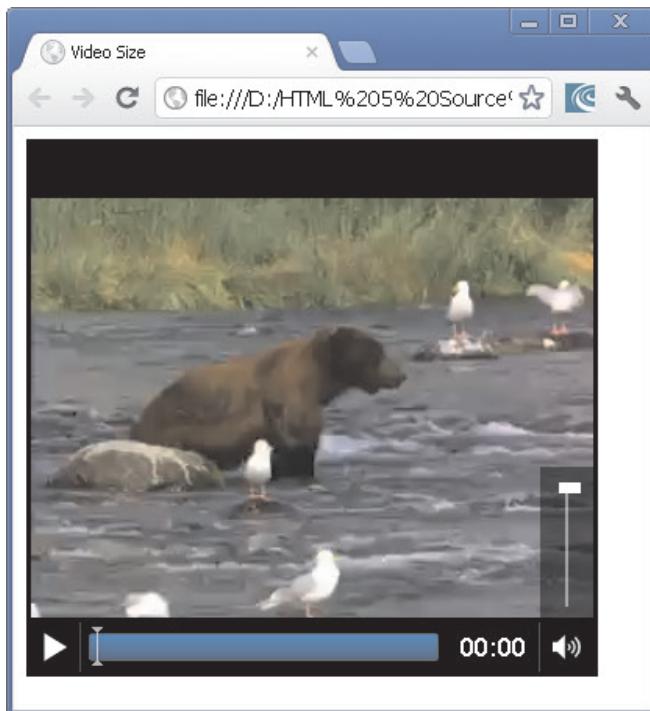


Figure 9.14: Width, Height, and Style Effect

9.11.4 Converting the Video Files

The `<video>` element used in HTML5 is a great feature, but how will the user get the video files in a correct format. There are many problems with browser vendors for supporting various video formats on the Websites. Following are some of the video formats supported by the significant browsers:

→ **Ogg/Theora**

This is an open source, royalty-free, and patent-free format available. This format is supported by browsers such as Opera, Chrome, and Firefox.

→ **WebM**

This is a royalty-free and patent-free format supported by Google. This format is supported by browsers such as Opera, Chrome, and Firefox. Free WebM Encoder 1.2 is a simple utility that allows you to convert video files to the WebM format.

→ **H.264/MP4**

H.264 or MP4 formats are supported on iPhone and Google Android devices.

There is a simple way to encode H.264 is by using the Handbrake. Handbrake is an open-source,

GPL-license application and is accessible by using Mac OS X, Windows, and Linux. Handbrake has two versions, command-line and graphical versions.

This format was available for free till 2015. This format is supported by browsers such as Internet Explorer, Chrome, and Safari.

→ **Micro Video Controller**

This converter creates all files that the user requires for HTML5 <video> element that works on the cross browser.

9.12 Accessibility of Audio and Video Elements

Enterprises across the world are employing people with varied skills and abilities. They may even include people with limited abilities or disabilities such as people with visual, cognitive, or mobility impairments. Accessibility is the level of ease with which computers can be used and be available to a wide range of users, including people with disabilities.

Applications can be accessed through various sources. If the application considers the requirements of the target audience, then it will be appreciated and used by number of users.

There are various types of users who will view the application containing the media content. Therefore, while developing an application a lot of assumptions are to be considered and some of them are as follows:

- Users can check the content on laptop, mobile, tablet, or desktop
- Users can listen to the audio by using headphones or speakers
- Users can understand the language in which the media was delivered
- Users can successfully play and download the media

These assumptions meet the requirements of a vast majority of users accessing the application. However, not all users will fall in this category. Therefore, another set of assumptions are to be considered for these users and they are as follows:

- Users who have hearing and visual impairment and thus, cannot listen to the audio or view the video
- Users who are not familiar with the language that the content is delivered
- Users who use keyboards and screen readers to access the content on Web
- Users who cannot view or hear the media content because of their working environment or due to device restrictions

HTML5 provides powerful features to make applications accessible to such users.

Web Video Text Tracks (WebVTT) is a file format used to mark up the external text tracks. This format allows the user to give a textual description of the content in the video. This description is then used by different accessibility devices to define the content to those users who cannot see it.

9.12.1 Track Element

The track element provides an easy, standard way to add captions, subtitles, chapters, and screen reader descriptions to the `<audio>` and `<video>` elements. Track elements are also used for other types of timed metadata. The source data for this track element is in a form of a text file that is made up of a list of timed cues. A cue is a pointer at an accurate time point in the length of a video. These cues contain data in formats such as Comma-Separated Values (CSV) or JavaScript Object Notation (JSON).

The track element is not supported in many major browsers. This track element is now available in IE 10 and Chrome 18+ onwards.

Table 9.6 lists the track element attributes.

Container	Description
src	Contains URL of the text track data
srclang	Contains language of the text track data
kind	Contains type of content the track definition is used for
default	Indicates that this will be the default track if the user does not specify value
label	Specifies title to be displayed for the user

Table 9.6: Track Element Attributes

Code Snippet 18 demonstrates how a track element is used in combination with `<video>` element for providing subtitles.

Code Snippet 18:

```
<video controls>
    <source src="myvideo.mp4" type="video/mp4">
    <source src="myvideo.webm" type="video/webm">
    <track src="eng.vtt" label="English p subtitles" kind="subtitles"
           srclang="en" >
</video>
```

This code specifies the `src`, `label`, and `srclang` attributes in the track element. Here, the `srclang` is set to `en` that is English language.

Code Snippet 19 demonstrates a track element used in combination with `<video>` element providing subtitles in another language.

Code Snippet 19:

```
<video controls>
    <source src="myvideo.mp4" type="video/mp4">
    <source src="myvideo.webm" type="video/webm">
```

```
<track src="de.vtt" srclang="de" label="German p subtitles"
       kind="subtitles">
</video>
```

This code specifies the `src`, `label`, and `srclang` attributes in the `track` element. Here, the `srclang` is set to `de` which represents French language.

9.12.2 Accessibility for Audio and Video Element

There are some accessibility supports for `<audio>` and `<video>` elements. These are as follows:

→ **Audio Support**

Following are the accessibility support for `<audio>` elements:

- **Firefox** - This browser exposes controls with accessibility APIs, however, individual controls do not interact with keyboard. The access to keyboard is provided by the Firefox specific shortcuts.
- **Opera** - This browser has only keyboard support.
- **IE 9** - This browser expose controls with accessibility APIs, however individual controls do not interact with keyboard.

→ **Video Support**

Following are the accessibility support for `<video>` elements:

- **Firefox** - This browser cannot interact with individual controls.
- **Opera** - This browser has only keyboard support.
- **IE 9** - This browser does not allow individual controls to interact with keyboard.

9.13 Non-Supporting Browsers

There are many browsers that do not support HTML5 elements. Browsers such as Firefox, Chrome, Opera, and Safari support the `<audio>` and the `<video>` elements. Google Chrome 17 and lower version has no support for `<audio>` elements. Similarly, Safari browser does not support `<audio>` element in HTML5. Internet Explorer 8 and earlier versions do not support the `<audio>` and the `<video>` elements.

9.14 Check Your Progress

1. Which of the following statements are true for tables?

(A)	A table is made up of rows and columns	(C)	A row is made up of a set of cells that are placed horizontally
(B)	The intersection of each row and column is called as a cell	(D)	A column is not made up of a set of cells that are placed vertically

2. Which of the following element is used to specify the heading for columns in a table?

(A)	<style>	(C)	<tr>
(B)	<td>	(D)	<th>

3. Identify the attribute that allows spanning of cell horizontally.

(A)	rowspan	(C)	meta
(B)	colspan	(D)	div

4. Which of the following option represent the possible values that can be used to vertically align the content within a table?

(A)	top	(C)	middle
(B)	justify	(D)	bottom

5. _____ is a combination of various elements such as video, graphics, and text.

(A)	Audio	(C)	Video
(B)	Multimedia	(D)	Autoplay

6. _____ is a new open source video container format supported by Google.

(A)	Flv	(C)	Avi
(B)	Ogg	(D)	WebM

7. _____ is the level of ease with which computers can be used and be available to a wide range of users, including people with disabilities.

(A)	Promotability	(C)	Accessibility
(B)	Navigability	(D)	Viewability

Frontend Technologies for Beginners

8. Andy is working on an online banking Website. He wants to create a table for displaying rate of interest allowed by the bank for different types of accounts. He also wants to give custom width for columns in the table. Which of the following code can he use to accomplish this task?

(A)	<pre><table border="1"> <tr> <td style="height: 20px">Savings</td> <td style="height: 80px">Current</td> </tr> <tr> <td style="height:30px">4%</td> <td style="height: 70px">10%</td> </tr> </table></pre>
(B)	<pre><table border="1"> <tr> <td style ="20px">Savings</td> <td style ="80px">Current</td> </tr> <tr> <td style ="30px">4%</td> <td style ="70%">10px</td> </tr> </table></pre>
(C)	<pre><table border="1"> <tr> <td style ="width: 100px">Savings</td> <td style ="width: 200px">Current</td> </tr> <tr> <td style ="width: 100px">4%</td> <td style ="width: 200px">10%</td> </tr> </table></pre>

Savings	Current
4%	10%

(D)

9.14.1 Answers

1.	A, B, C
2.	D
3.	B
4.	A, C, D
5.	B
6.	D
7.	C
8.	C

Summary

- Tables allow the user to view your data in a structured and classified format.
- Padding is the amount of space between the content and its outer edge.
- The caption element defines a caption for a table. It is a sub-element of the <table> element.
- Spanning refers to a process of extending a cell across multiple rows or columns.
- The rowspan attribute spans a data cell across two or more rows.
- The colspan attribute allows the user to specify the number of columns a cell should span.
- The border attribute of the table element allows the user to specify a border for making the table visible in a Web page.
- Tables allow the user to organize the data. It enables the developer to design a Web page having an attractive page layout.
- Multimedia is a combination of various elements such as video, graphics, sound, and text.
- There are various media types used for audio and video files on different Websites.
- The <audio> element will help the developer to embed music on the Website and allow the user to listen to music.
- Users can play the audio in older browsers using the <embed> tag.
- The <video> element is used for embedding the video content on the Web page.
- Preload attribute identifies whether the audio has to be loaded when the page loads and is ready to execute.
- WebM is a new open source video container format supported by Google.

Try It Yourself

1. Samson works for an advertising agency and is headquartered at Hong Kong. He is very fond of learning latest technologies that are coming up in the market. He wants to create an HTML5 Website for his company. The company offers a number of services such as designing of logos, new media, promotions, and branding. Samson wants to develop their company Website home page and also wants to add all the details about the company with additional graphics, text, animations, and arrange the content in an organized manner. He has decided to use tables for the Home page. Help him to develop the application.

2. Carol is working on an online shopping Website. This Website has a wide range of collection for men, women, and kids. The Website deals with many branded products such as bags, shoes, clothes, jewelry, beauty products, and many more. The Website was created earlier using HTML 4 version. Now, she has decided to upgrade the Website with HTML5. She wants to change the appearance and layout of the entire Website by adding page layouts to the Website using the new features of HTML5 so that the Website is appealing and attractive for the new generation. Help her to design the Website using new features of HTML5.

3. Julia works for a music online Website named, Crayon Developers and is headquartered at Tokyo, Japan. The Website contains the information about different genre of music such as jazz, opera, rock, and many more. Now, she wants to add the list of newly launched albums to the Website. She wants to add some audio files to the Website for the listeners that will create a different impact on the customers. Help her to develop the application.

4. Ching Chow works for an online music company named, MovieBuzz and is headquartered at Yokohama, China. She has created her company's Website on HTML 4 now she wants to upgrade her company's Website to HTML5. The Website contains the information about the latest Hollywood movies and review of the released movies. She wants to add the new movie releases to her collection of movies where the visitors can view some video clips of movies. Help her to develop the application.



Session - 10

JavaScript - I

Welcome to the Session, **JavaScript-I**.

This session describes the scripting languages. The session also explores the JavaScript language and versions used in the language. It further describes the variables, data types, methods, built in functions, event handling, and jQuery mobile.

In this Session, you will learn to:

- ➔ Explain scripting
- ➔ Explain the JavaScript language
- ➔ Explain the client-side and server-side JavaScript
- ➔ List the variables and data types in JavaScript
- ➔ Describe the JavaScript methods to display information
- ➔ Explain escape sequences and built in functions in JavaScript
- ➔ Explain events and event handling
- ➔ Explain jQuery
- ➔ Describe how to use the jQuery Mobile
- ➔ Explain operators and their types in JavaScript
- ➔ Explain regular expressions in JavaScript
- ➔ Explain decision-making statements in JavaScript
- ➔ Explain while loop
- ➔ Explain for loop
- ➔ Explain do..while loop
- ➔ Explain break and continue statement
- ➔ Explain single-dimensional arrays
- ➔ Explain multi-dimensional arrays
- ➔ Explain for..in loop

10.1 Introduction

A scripting language refers to a set of instructions that provides some functionality when the user interacts with a Web page. Scripting languages are often embedded in the HTML pages to change the behavior of the Web pages according to the user's requirements.

Figure 10.1 displays a scenario that uses scripting.

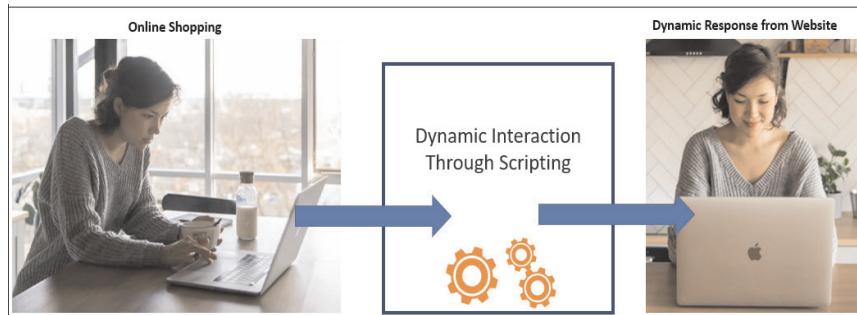


Figure 10.1: Scripting

10.2 Scripting

Client-side Scripting refers to a script being executed on the client's machine by the browser. Whereas, **Server-side Scripting** refers to a script being executed on a Web server to generate dynamic HTML pages.

10.3 JavaScript

JavaScript is a scripting language that allows you to build dynamic Web pages by ensuring maximum user interactivity. JavaScript language is an object-based language, which means that it provides objects for specifying functionalities. In real life, an object is a visible entity such as a car or a table. Each object has some characteristics and is capable of performing certain actions. Similarly, in a scripting language, an object has a unique identity, state, and behavior.

The identity of the object distinguishes it from the other objects of the same type. The state of the object refers to its characteristics, whereas the behavior of the object consists of its possible actions. The object stores its identity and state in fields (also called variables) and exposes its behavior through functions (actions).

Figure 10.2 displays some objects.

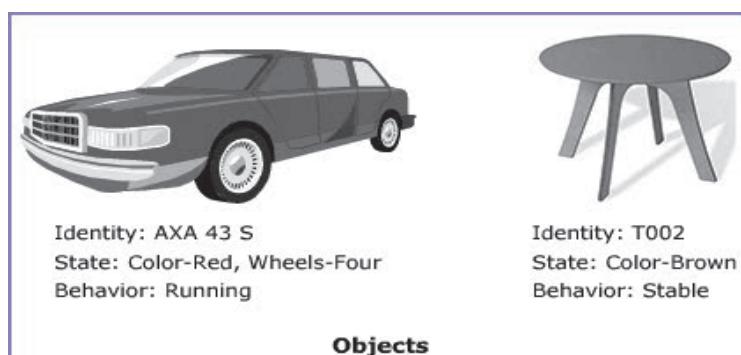


Figure 10.2: Objects

10.4 Versions of JavaScript

The first version of JavaScript was developed by Brendan Eich at Netscape in 1995 and was named JavaScript 1.0. Netscape Navigator 2.0 and Internet Explorer 3.0 supported JavaScript 1.0. Over the period, it gradually evolved with newer versions where each version provided better features and functionalities as compared to their previous versions.

Table 10.1 lists various versions of JavaScript language, also called as ECMAScript.

Edition	Name	Description
1	ECMAScript 1 (1997)	First edition
2	ECMAScript 2 (1998)	Supported by Internet Explorer from version 4.0
3	ECMAScript 3 (1999)	Added regular expressions and <code>try/catch</code> and was supported by Internet Explorer 5.0, Netscape Navigator 4.0, and Opera 5.0 onwards
5	ECMAScript 5 (2009)	Added features such as 'strict mode' JSON support, <code>String.trim()</code> , <code>Array.isArray()</code> , and Array iteration methods. Is supported by Internet Explorer 6.0 and Mozilla Firefox 1.0 onwards
6	ECMAScript 2015	Was published in 2015 and added features such as <code>let</code> and <code>const</code> , default parameter values, <code>Array.find()</code> , and <code>Array.findIndex()</code>
7	ECMAScript 2016	Was published in 2016 and added exponential operator and <code>Array.prototype.includes</code>
8	ECMAScript 2017	Was published in 2017 and added features such as string padding, <code>Object.entries</code> , <code>Object.values</code> , <code>async</code> functions, and shared memory
9	ECMAScript 2018	Was published in 2018 and added features such as rest/spread properties, asynchronous iteration, and <code>Promise.finally()</code>
10	ECMAScript 2019	Was published in 2019 and added features such as <code>Array.prototype.flat</code> , <code>Array.prototype.flatMap</code> , and <code>Object.fromEntries</code>
11	ECMAScript 2020	Was published in June 2020 and introduces a <code>BigInt</code> primitive type for arbitrary-sized integers, nullish coalescing operator, and <code>globalThis</code> object
12	ECMAScript 2021	Was published in June 2021 and introduces <code>replaceAll</code> method for <code>Strings</code> , <code>Promise.any</code> , <code>AggregateError</code> , <code>WeakRef</code> , and other features
13	ECMAScript 2022	Was published in June 2022.

Table 10.1: Various Versions of JavaScript Language

Note - ECMAScript 4 was abandoned.

10.5 Client-side JavaScript

JavaScript is a scripting language, which can be executed on the client-side and on the server-side. A client-side JavaScript (CSJS) is executed by the browser on the user's workstation. A client-side script might contain instructions for the browser to handle user interactivity. These instructions might be to change the look or content of the Web page based on the user inputs. Examples include displaying a welcome page with the username, displaying date and time, validating that the required user details are filled, and so on.

A JavaScript is either embedded in an HTML page or is separately defined in a file, which is saved with .js extension. In client-side scripting, when an HTML is requested, the Web server sends all the required files to the user's computer. The Web browser executes the script and displays the HTML page to the user along with any tangible output of the script.

Figure 10.3 displays client-side JavaScript.

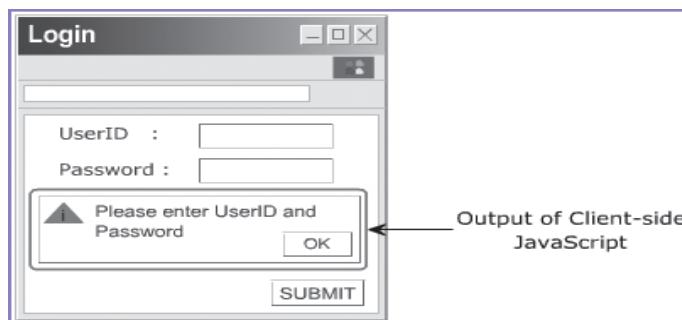


Figure 10.3: Client-side JavaScript

10.6 Server-side JavaScript

A server-side JavaScript (SSJS) is executed by the Web server when an HTML page is requested by a user. The output of a server-side JavaScript is sent to the user and is displayed by the browser. In this case, a user might not be aware that a script was executed on the server to produce the desirable output.

A server-side JavaScript can interact with the database, fetch the required information specific to the user, and display it to the user. This means that server-side scripting fulfills the goal of providing dynamic content in Web pages. Unlike client-side JavaScript, HTML pages using server-side JavaScript are compiled into bytecode files on the server. Compilation is a process of converting the code into machine-independent code. This machine-independent code is known as the bytecode, which is an executable file. The Web server runs this executable to generate the desired output.

Figure 10.4 displays the server-side JavaScript.

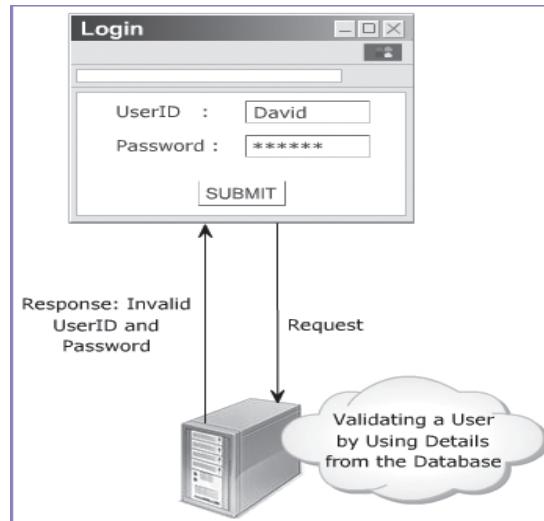


Figure 10.4: Server-side JavaScript

10.7 <Script> Tag

The `<script>` tag defines a script for an HTML page to make them interactive. The browser that supports scripts interprets and executes the script specified under the `<script>` tag when the page loads in the browser. You can directly insert a JavaScript code under the `<script>` tag. You can define multiple `<script>` tags either in the `<head>` or in the `<body>` elements of an HTML page. In HTML5, the type attribute specifying the scripting language is no longer required as it is optional.

Code Snippet 1 demonstrates the use of the `<script>` tag.

Code Snippet 1:

```
<!DOCTYPE html>
<html>
  <head>
    <script>
      document.write("Welcome to the Digital World");
    </script>
  </head>
  <body>
    ...
  </body>
</html>
```

There are two main purposes of the `<script>` tag, which are as follows:

- Identifies a given segment of script in the HTML page
- Loads an external script file

10.8 Variables in JavaScript

A variable refers to a symbolic name that holds a value, which keeps changing. For example, age of a student and salary of an employee can be treated as variables. A real-life example for variables includes the variables used in algebraic expressions that store values.

In JavaScript, a variable is a unique location in the computer's memory that stores a value and has a unique name. The name of the variable is used to access and read the value stored in it. A variable can store different types of data such as a character, a number, or a string. Therefore, a variable acts as a container for saving and changing values during the execution of the script.

10.8.1 Declaring Variables

Declaring a variable refers to creating a variable by specifying the variable name. For example, you can create a variable named `studName` to store the name of a student. Here, the variable name `studName` is referred to as an identifier. In JavaScript, the `var` keyword is used to create a variable by allocating memory to it. A keyword is a reserved word that holds a special meaning in JavaScript. You can initialize the variable at the time of creating the variable or later. Initialization refers to the task of assigning a value to a variable. Once the variable is initialized, you can change the value of a variable as required.

Variables allow keeping track of data during the execution of the script. While referring to a variable, you are referring to the value of that variable. In JavaScript, you can declare and initialize multiple variables in a single statement.

Following syntax demonstrates how to declare variables in JavaScript:

Syntax:

```
var <variableName>;
```

where,

`var`: Is the keyword in JavaScript.

`variableName`: Is a valid variable name.

Following syntax demonstrates how to initialize variables in JavaScript:

Syntax:

```
<variableName> = <value>;
```

where,

`=`: Is the assignment operator used to assign values.

`value`: Is the data that is to be stored in the variable.

Following syntax demonstrates how to declare and initialize multiple variables in a single statement, which are separated by commas.

Syntax:

```
var <variableName1> = <value1>, <variableName2> = <value2>;
```

Code Snippet 2 declares two variables namely, `studID` and `studName` and assign values to them.

Code Snippet 2:

```
var studID;  
var studName;  
studID = 50;  
studName = "David Fernando";
```

This code assigns values to `studID` and `studName` variables by using the assignment operator (`=`). The value named `David Fernando` is specified within double quotes.

Code Snippet 3 demonstrates how to declare and initialize multiple variables in a single statement in JavaScript.

Code Snippet 3:

```
var studName = David, studAge = 15;
```

10.8.2 Variable Naming Rules

You cannot refer to a variable until it is created in JavaScript. JavaScript is a case-sensitive language. This means that if you specify `x` and `X` as variables, both of them are treated as two different variables. Similarly, in JavaScript, there are certain rules, which must be followed while specifying variables names. These rules for a variable name are as follows:

- Can consist of digits, underscore, and alphabets.
- Must begin with a letter or the underscore character.
- Cannot begin with a number and cannot contain any punctuation marks.
- Cannot contain any kind of special characters such as `+`, `*`, `%`, and so on.
- Cannot contain spaces.
- Cannot be a JavaScript keyword.

It is recommended to give meaningful names to variables such that the name determines the kind of data stored in the variable.

10.9 Data Types in JavaScript

Data types in JavaScript are classified into two broad categories namely, primitive and composite data types. Primitive data types contain only a single value, whereas the composite data types contain a group of values.

10.9.1 Primitive Data Types

A primitive data type contains a single literal value such as a number or a string. A literal is a static value that you can assign to variables.

Table 10.2 lists the primitive data types.

Primitive Data Type	Description
boolean	Contains only two values namely, true or false
null	Contains only one value namely, null. A variable of this value specifies that the variable has no value. This null value is a keyword and it is not the same as the value, zero
number	Contains positive and negative numbers and numbers with decimal point. Some of the valid examples include 6, 7.5, -8, 7.5e-3, and so on
string	Contains alphanumeric characters in single or double quotation marks. The single quotes is used to represent a string, which itself consists of quotation marks. A set of quotes without any characters within it is known as the null string

Table 10.2: Primitive Data Types

10.9.2 Composite Data Types

A composite data type stores a collection of multiple related values, unlike primitive data types. In JavaScript, all composite data types are treated as objects. A composite data type can be either predefined or user-defined in JavaScript.

Table 10.3 lists the composite data types.

Data Type	Description
Objects	Refers to a collection of properties and functions. Properties specify the characteristics and functions determine the behavior of a JavaScript object
Functions	Refers to a collection of statements, which are instructions to achieve a specific task
Arrays	Refers to a collection of values stored in adjacent memory locations

Table 10.3: Composite Data Types

10.10 Methods

JavaScript allows you to display information using the methods of the document object. The document object is a predefined object in JavaScript, which represents the HTML page and allow managing the page dynamically. Each object in JavaScript consists of methods, which fulfills a specific task. There are two methods of the document object, which displays any type of data in the browser. These methods are as follows:

- `write()`: Displays any type of data.
- `writeln()`: Displays any type of data and appends a new line character.

Following syntax demonstrates the use of `document.write()` method, which allows you to display information in the displayed HTML page:

Syntax:

```
document.write("<data>" + variables);
```

where,

`data`: Specifies strings enclosed in double quotes.

variables: Specify variable names whose value should be displayed on the HTML page.

Code Snippet 4 demonstrates the use of `write()` method.

Code Snippet 4:

```
<!DOCTYPE HTML>
<html>
<head>
<title>JavaScript language </title>
<script>
    document.write("<p>JavaScript:</p>");
    document.writeln("is a scripting");
    document.write("and a case-sensitive language.");
</script>
</head>
<p>      JavaScript: is a scripting and a case-sensitive language. </p>
</html>
```

The code uses the `writeln()` method to display the text after the colon without leaving a space. It finally appends a new line character after the text. Then, the text within the `write()` method is displayed on the same line after leaving a space.

The same paragraph is displayed in the body of the HTML page. Note that the text in the `p` element appears on different lines. In HTML, the text on the second line and a case sensitive language will not be displayed in the new line in the browser even though the **Enter** key is pressed while writing the code. Rather, it will be displayed on the same line with a space. The `writeln()` method also follows this same format.

Figure 10.5 displays the use of `write()` and `writeln()` methods.

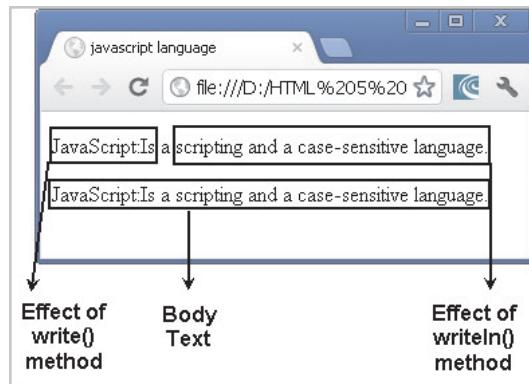


Figure 10.5: Use of `write()` and `writeln()` Methods

10.11 Using Comments

A Web page designer might code complex script to fulfill a specific task. In JavaScript, a Web page designer specifies comments to provide information about a piece of code in the script. Comments describe the

code in simple words so that somebody who reads the code can understand the code. Comments are small piece of text that makes the program more readable. While the script is executed, the browser can identify comments as they are marked with special characters and do not display them.

JavaScript supports two types of comments. These are as follows:

→ **Single-line Comments**

Single-line comments begin with two forward slashes (//). You can insert single-line comments as follows:

```
// This statement declares a variable named num.  
var num;
```

→ **Multi-line Comments**

Multi-line comments begin with a forward slash followed by an asterisk /*) and end with an asterisk followed by a forward slash (*\). You can insert multiple lines of comments as follows:

```
/* This line of code  
declares a variable */  
var num;
```

10.12 Escape Sequence Characters

An escape sequence character is a special character that is preceded by a backslash (\). Escape sequence characters are used to display special non-printing characters such as a tab space, a single space, or a backspace. These non-printing characters help in displaying formatted output to the user to maximize readability. The backslash character specifies that following character denotes a non-printing character. For example, \t is an escape sequence character that inserts a tab space similar to the **Tab** key of the keyboard. In JavaScript, the escape sequence characters must always be enclosed in double quotes.

There are multiple escape sequence characters in JavaScript that provides various kind of formatting.

Table 10.4 lists the escape sequence characters.

Escape Sequence	Non-Printing Character
\b	Back space
\f	Form feed
\n	New line
\r	Carriage return
\t	Horizontal tab
\'	Single quote
\"	Double quote
\\\	Backslash
\aaa	Matches a Latin-1 encoding character using octal representation, where aaa are three octal numbers. For example, \251 represents the copyright symbol

Escape Sequence	Non-Printing Character
\xaa	Matches a Latin-1 encoding character using hexadecimal representation, where aa are two hexadecimal numbers. For example, \x61 represents the character 'a'
\aaaa	Represent the Unicode encoding character, where aaaa are four hexadecimal numbers. For example, the character \u0020 represents a space

Table 10.4: Escape Sequence Characters

Code Snippet 5 demonstrates the use of escape sequence characters in JavaScript.

Code Snippet 5:

```
<script>
  document.write("You must have a \"credit card\", if you
    want to shop on the 'Internet'.");
</script>
```

The code uses a Unicode encoding character namely, \u0022, which represents double quotes. These open and close double quotes will contain the term credit card. Similarly, the word Internet will be placed in single quotes. The single quotes are specified using the backslash character.

10.13 Built-in Functions

A function is a piece of code that performs some operations on variables to fulfill a specific task. It takes one or more input values, processes them, and returns an output value. JavaScript provides built-in functions that are already defined to fulfill a certain task. Table 10.5 lists the built-in functions.

Function	Description	Example
alert()	Displays a dialog box with some information and OK button	alert("Please fill all fields of the form"); Displays a message box with the instruction
parseInt()	Converts a string value into a numeric value	parseInt("25 years");
parseFloat()	Converts a string into a number with decimal point	parseFloat("10.33"); Returns 10.33
eval()	Evaluates an expression and returns the evaluated result	eval("2+2"); Returns 4
prompt()	Displays a dialog box that accepts an input value through a text box. It also accepts default value for text box.	prompt("Enter your name", "Name"); Displays message in dialog box and Name in text box.

Table 10.5: Built-in Functions

Code Snippet 6 demonstrates use of some of the built-in functions in JavaScript. It performs addition operation using JavaScript.

Code Snippet 6:

```
<!DOCTYPE HTML>
<html>
<head>
<title> JavaScript language </title>
<script>
    var value = "";
    var numone = prompt("enter first value to perform the
                        multiplication operation", value);
    var numtwo = prompt("enter second value to perform the
                        multiplication operation", value);
    var result = eval(numone * numtwo);
    document.write("The result of multiplying: " + numone + "
                  and " + numtwo + " is: " + result + ".");
</script>
</head>
</html>
```

In the code, it takes the first value from the user and stores in the `numOne` variable. Then, it takes the second value from the user and stores in the `numTwo` variable. It multiplies the values and stores the output in the `result` variable and then, displays the output on the Web page.

Figure 10.6 displays the input for first number.

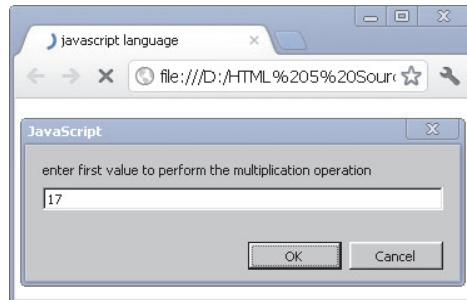


Figure 10.6: Input For First Number

Figure 10.7 displays the input for second number.

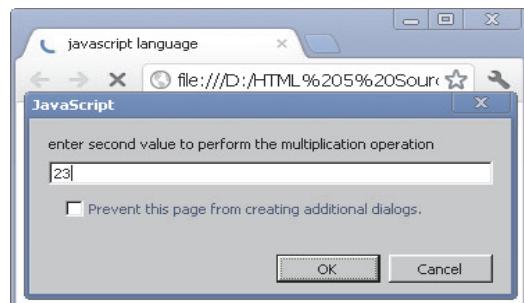


Figure 10.7: Input For Second Number

Figure 10.8 displays the result.



Figure 10.8: Result

10.14 Events

Consider a scenario where you want to design an Employee registration Web form. This form allows the users to fill in appropriate details and click the submit button. When the user clicks the submit button, the form data is submitted to the server for validation purposes. In this case, when the user clicks the button, an event is generated. The submission of form refers to the action performed on click of the button.

An event occurs when a user interacts with the Web page. Some of the commonly generated events are mouse clicks, key strokes, and so on. The process of handling these events is known as event handling.

10.14.1 Event Handling

Event handling is a process of specifying actions to be performed when an event occurs. This is done by using an event handler. An event handler is a scripting code or a function that defines the actions to be performed when the event is triggered.

When an event occurs, an event handler function that is associated with the specific event is invoked. The information about this generated event is updated on the `event` object. The `event` object is a built-in object, which can be accessed through the `window` object.

It specifies the event state, which includes information such as the location of mouse cursor, element on which an event occurred, and state of the keys in a keyboard.

Figure 10.9 displays the event handling.

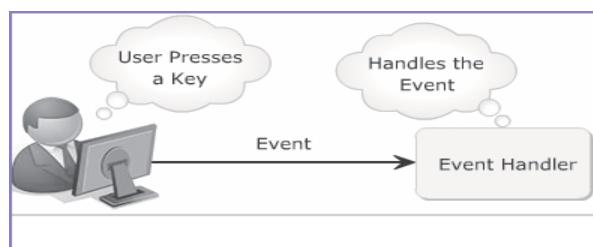


Figure 10.9: Event Handling

10.14.2 Event Bubbling

Event bubbling is a mechanism that allows you to specify a common event handler for all child elements. This means that the parent element handles all the events generated by the child elements. For example, consider a Web page that consists of a paragraph and a table. The paragraph consists of multiple occurrences of italic text. Now, you want to change the color of each italic text of a paragraph when the

user clicks a particular button. Instead of declaring an event handler for each italic text, you can declare it within the P element. This allows you to apply colors for all the italic text within the paragraph. This helps in reducing the development time and efforts since it minimizes the code. Figure 10.10 displays the event bubbling.

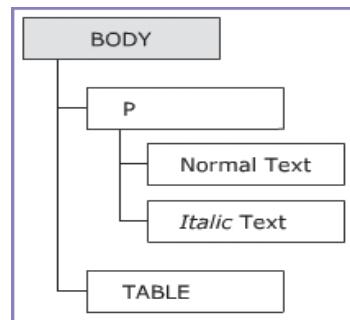


Figure 10.10: Event Bubbling

10.14.3 Life Cycle of an Event

An event's life starts when the user performs an action to interact with the Web page. It finally ends when the event handler provides a response to the user's action.

Steps involved in the life cycle of an event are as follows:

- The user performs an action to raise an event.
- The event object is updated to determine the event state.
- The event is fired.
- The event bubbling occurs as the event bubbles through the elements of the hierarchy.
- The event handler is invoked that performs the specified actions.

10.14.4 Keyboard Events

Keyboard events are the events that occur when a key or a combination of keys are pressed or released from a keyboard. These events occur for all keys of a keyboard.

Different keyboard events are as follows:

- **Onkeydown**
Occurs when a key is pressed down.
- **Onkeyup**
Occurs when the key is released.
- **Onkeypress**
Occurs when a key is pressed and released.

Code Snippet 7 demonstrates how to create a JavaScript code that defines the event handlers.

Code Snippet 7:

```
function numericonly()  {
    if(!event.keyCode >=48 && event.keyCode<=57)
        event.returnValue=false;
}
function countWords()  {
    var message = document.getElementById('txtMessage').value;
    message= message.replace(/\s+/g, ' ');
    var numberofWords = message.split(' ').length;
        document.getElementById('txtTrack').value = words Remaining:
        ' + eval(50 - numberofWords);
    if(numberofWords > 50)
        alert("too many words.");
}
```

In the code, the function `numericOnly()` declares an event handler function, `numericOnly()`. The `event.keyCode` checks if the Unicode character of the entered key is greater than 48 and less than 57. This checks that only numeric values are entered. It also declares an event handler function, `countWords()`. It retrieves the text specified in the `txtMessage` control. `split()` function splits the specified string when a space is encountered and returns the length after splitting. It also calculates and displays the number of remaining words to complete the count of 50 words. If the number of words is greater than 50, an alert box is displayed.

10.14.5 Mouse Events

Mouse events occur when the user clicks the mouse button. Table 10.6 lists the mouse events.

Events	Description
onmousedown	Occurs when the mouse button is pressed
onmouseup	Occurs when the mouse button is released
onclick	Occurs when the mouse button is pressed and released
ondblclick	Occurs when the mouse button is double-clicked
onmousemove	Occurs when the mouse pointer is moved from one location to other
onmouseover	Occurs when the mouse pointer is moved over the element
onmouseout	Occurs when the mouse pointer is moved out of the element

Table 10.6: Mouse Events

Code Snippet 8 demonstrates the use of different mouse events.

Code Snippet 8:

```
<!DOCTYPE HTML>
<html>
<head>
<title>Reservation</title>
<script src="form.js"> </script>
</head>
<body>
<h2>Hotel Reservation Form</h2>
<form id="frmreservation">
<table>
<tr>
<td><label for="txtName">Name:</label></td>
<td><input id="txtName" type="text" /></td>
</tr>
<tr>
<td>Arrival Date:</td>
<td><input id="txtArrival" type="text" /></td>
</tr>
<tr> <td>Departure Date:</td>
<td><input id="txtDeparture" type="text" /></td>
</tr>
<tr> <td>Number of Person:</td>
<td><input id="txtPerson" type="text" maxlength="3"
size="3"></td>
</tr>
<tr>
<td>
</td>
<td>
</td>
</tr>

```

```
</table>
</form>
</body>
</html>
```

In the code, an image is displayed when Submit button is clicked. It will also display the submit.jpg image when the mouse is released from Submit button. It also submits the form data when the Submit button is clicked.

Further it displays the image when Reset button is clicked and it displays the reset.jpg image when the mouse is released from Reset button. It will reset the form data when the Reset button is clicked.

Code Snippet 9 demonstrates the loading of images in a JavaScript file.

Code Snippet 9:

```
function showImage (object,url)
{
    object.src=url;
}
```

Figure 10.11 displays the output of mouseup.

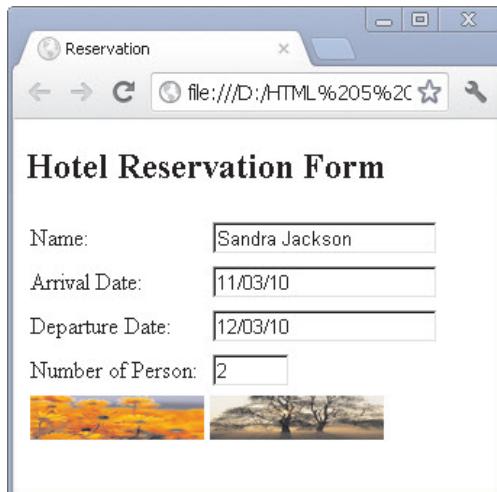


Figure 10.11: Output of MouseUp

Figure 10.12 displays the output on mousedown.

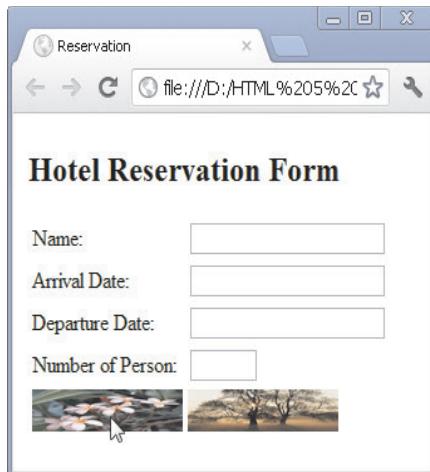


Figure 10.12: Output On MouseDown

10.14.6 Focus and Selection Events

The focus events determine the activation of various elements that uses the `input` element. It allows you to set or reset focus for different `input` elements. The selection events occur when an element or a part of an element within a Web page is selected. Table 10.7 lists the focus and selection events.

Events	Description
onfocus	Occurs when an element receives focus
onblur	Occurs when an element loses focus
onselectstart	Occurs when the selection of an element starts
onselect	Occurs when the present selection changes
ondragstart	Occurs when the selected element is moved

Table 10.7: Focus and Selection Events

Code Snippet 10 demonstrates the use of focus and selection events.

Code Snippet 10:

```
<!DOCTYPE HTML>
<html>
<head>
<title>Reservation</title>
<script>
    function showStyle(field) {
        field.style.backgroundColor = '#FFFFCC' ;
    }
    function hideStyle(field) {
        field.style.backgroundColor = '#FFFFFF' ;
    }
</script>

```

```
function setFontStyle(field)  {
    field.style.fontWeight = 'bold';
    field.style.fontFamily = 'Arial';
}

</script>
</head>

<body>
    <h2> Feedback Form </h2>
    <form id="frmreservation" >
        <table>
            <tr>
                <td><label for="txtName">Name:</label></td>
                <td><input id="txtName" type="text" onfocus="showStyle(this);"
onblur="hideStyle(this); onselect=setFontStyle(this); />
                </td>
            </tr>
            <tr>
                <td><label for="txtEmail">E-mail:</label></td>
                <td><input id="txtEmail" type="text" onfocus="showStyle(this);"
onblur="hideStyle(this); onselect=setFontStyle(this); />
                </td>
            </tr>
            <tr>
                <td><label for="txtComment">Comment:</label></td>
                <td><textarea id="txtComment" cols="15" rows="3"
onfocus="showStyle(this); onblur="hideStyle(this);"
onselect=setFontStyle(this);></textarea>
                </td> </tr>
            <tr>
                <td><input id="btnSubmit" type="button" type="button" value="Submit" /></td>
                <td><input id="btnReset" type="reset" /></td>
            </tr>
        </table>
    </form>
</body>
</html>
```

In the code, a specified style is displayed when the element receives and loses focus. It also displays the specified font style when the element is selected. It also declares an event handler function and specifies the background color for the field. It sets the font style for text to bold and the text should appear in Arial font.

Figure 10.13 displays the focus and selection events.



Figure 10.13: Focus and Selection Events

10.15 jQuery

jQuery is a short and fast JavaScript library developed by John Resig in 2006 with a wonderful slogan: **Write less and do more**. It simplified the client-side scripting of HTML.

jQuery also simplifies HTML files animation, event handling, traversing, and developing AJAX based Web applications. It helps in rapid Web application development. jQuery is designed for simplifying several tasks by writing lesser code. Following are the key features supported by jQuery:

- **Event Handling:** jQuery has a smart way to capture a wide range of events, such as user clicks a link, without making the HTML code complex with event handlers.
- **Animations:** jQuery has many built-in animation effects that the user can use while developing their Websites.
- **DOM Manipulation:** jQuery easily selects, traverses, and modifies DOM by using the cross-browser open source selector engine named Sizzle.
- **Cross Browser Support:** jQuery has a support for cross-browser and works well with many modern browsers.
- **Lightweight:** jQuery has a lightweight library of 19 KB size.
- **AJAX Support:** jQuery helps you to develop feature-rich and responsive Websites by using AJAX technologies.
- **Latest Technology:** jQuery supports basic XPath syntax and CSS3 selectors.

10.15.1 Using jQuery Library

There is an easy way to use jQuery library. To work with jQuery perform following steps:

1. Download the jQuery library from the <http://jquery.com/> Website (Select **jquery-3.6.3.min.js**)
2. Place the **jquery-3.6.3.min.js** file in the current directory of the Website
3. Include jQuery library in your code

Code Snippet 11 shows how to use a jQuery library.

Code Snippet 11:

```
<!DOCTYPE HTML>
<html>
<head>
<title>The jQuery Example</title>
    // Using jQuery library
<script src=" jquery-3.6.3.min.js">
    // The user can add our JavaScript code here
</script>
</head>
...
</html>
```

10.15.2 Calling jQuery Library Functions

Users can do many tasks while jQuery is reading or manipulating the DOM object. Users can add the events only when the DOM object is ready. If the user wants the event on their page then, the user has to call the event in the `$(document).ready()` function. All the content inside the event will be loaded as soon as the DOM is loaded but before the contents of the page are loaded. Users also register the ready event for the document. Place the `jquery-3.6.3.min.js` file in the current directory and specify the location of this file in the `src` attribute.

Code Snippet 12 shows how to call jQuery library function and ready event in DOM.

Code Snippet 12:

```
<!DOCTYPE HTML>
<html>
<head>
<title>The jQuery Example</title>
<script src=" jquery-3.6.3.min.js">
</script>
<script>
$(document).ready(function() {
    $("div").click(function() {
```

```
        alert("Welcome to the jQuery world!") ;
    } );
} );
</script>
</head>
<body>
<div id="firstdiv">
    Click the text to view a dialog box.
</div>
</body>
</html>
```

The code includes the jQuery library and also registers the ready event for the document. The ready event contains the click function that calls the click event.

10.16 Introduction to JavaScript Operators

An operator specifies the type of operation to be performed on the values of variables and expressions. JavaScript provides different types of operators to perform simple to complex calculations and evaluations. Certain operators are also used to construct relational and logical statements. These statements allow implementing decision and looping constructs. JavaScript provides a predefined set of operators that allow performing different operations. JavaScript operators are classified into six categories based on the type of action they perform on operands.

10.16.1 Arithmetic Operators

Arithmetic operators are binary operators, as they perform basic arithmetic operations on two operands. The operator appears in between the two operands, which allow you to perform computations on numeric and string values. These computations include addition, subtraction, multiplication, and division.

Table 10.8 lists the arithmetic operators with their descriptions and an example of each type.

Arithmetic Operator	Description	Example
+ (Addition)	Performs addition. In case of string values, it behaves as a string concatenation operator and appends a string at the end of the other	45 + 56
- (Subtraction)	Performs subtraction. If a larger value is subtracted from a smaller value, it returns a negative numeric value	76-78
/ (Division)	Divides the first operand by the second operand and returns the quotient	24 / 8
% (Modulo)	Divides the first operand by the second operand and returns the remainder	90 % 20
* (Multiplication)	Multiplies the two operands	98 * 10

Table 10.8: Arithmetic Operators

Code Snippet 13 calculates the loan interest and the total loan amount to be repaid by using the arithmetic operators.

Code Snippet 13:

```
<script>
    var loanAmount = 34500;
    var interest = 8;
    var interestAmount, totalAmount;
    interestAmount = loanAmount * (interest / 100);
    totalAmount = loanAmount + interestAmount;
    document.write("<B>Total amount to be paid ($):</B>" +
    totalAmount + "<BR />");
</script>
```

The code uses the arithmetic operators * and / to calculate the interest amount. This interest amount is then added to the total amount by using the + operator. The `write()` method displays the total amount to be repaid on the loan.

10.16.2 Increment and Decrement Operators

The increment and decrement operators are unary operators, as they operate only on a single operand. The increment operator (++) increases the value by 1, while the decrement operator (--) decreases the value by 1. These operators can be placed either before or after the operand. If the operator is placed before the operand, the expression is called pre-increment or pre-decrement. If the operator is placed after the operand, the expression is called post-increment or post-decrement.

Table 10.9 demonstrates the use of increment and decrement operators by assuming that the `numOne` variable's value is 2.

Expression	Type	Result
<code>numTwo = ++numOne;</code>	Pre-increment	<code>numTwo = 3</code>
<code>numTwo = numOne++;</code>	Post-increment	<code>numTwo = 2</code>
<code>numTwo = --numOne;</code>	Pre-decrement	<code>numTwo = 1</code>
<code>numTwo = numOne--;</code>	Post-decrement	<code>numTwo = 2</code>

Table 10.9: Increment and Decrement Operators

Code Snippet 14 demonstrates the use of unary operators in JavaScript.

Code Snippet 14:

```
<script>
    var number = 3;
    alert('Number after increment = ' + ++number);
```

```
    alert('Number after decrement = ' + number--);  
</script>
```

The first `alert()` function will display the incremented value of the `number` variable. This is because in the first statement, `++` operator is evaluated first and then, the incremented value is substituted in the variable `number`. The second `alert()` function will not display the decremented value of the `number` variable. This is because the current value is first assigned to the variable, and then, the `--` operator is evaluated.

10.16.3 Relational Operators

Relational operators are binary operators that make a comparison between two operands. After making a comparison, they return a boolean value namely, `true` or `false`. The expression consisting of a relational operator is called as the relational expression or conditional expression.

Table 10.10 lists the relational operators along with their descriptions and an example of each type.

Relational Operator	Description	Example
<code>== (Equal)</code>	Verifies whether the two operands are equal	<code>90 == 91</code>
<code>!= (Not Equal)</code>	Verifies whether the two operands are unequal	<code>99 != 98</code>
<code>=== (Strict Equal)</code>	Verifies whether the two operands are equal and whether are of the same type	<code>3 === 4</code>
<code>!== (Strict Not Equal)</code>	Verifies whether the two operands are unequal and whether are not of the same type	<code>3 !== "3"</code>
<code>> (Greater Than)</code>	Verifies whether the left operand is greater than the right operand	<code>97 > 95</code>
<code>< (Less Than)</code>	Verifies whether the left operand is less than the right operand	<code>94 < 96</code>
<code>>= (Greater Than or Equal)</code>	Verifies whether the left operand is greater than or equal to the right operand	<code>92 >= 93</code>
<code><= (Less Than or Equal)</code>	Verifies whether the left operand is less than or equal to the right operand	<code>99 <= 100</code>

Table 10.10: Relational Operators

Code Snippet 15 compares the value of the `firstNumber` variable with the value of the `secondNumber` variable using relational operators.

Code Snippet 15:

```
<script>  
    var firstNumber = 3;  
    var secondNumber = 4;  
  
    document.write('First number is greater than the second number: ' +  
        (firstNumber > secondNumber));  
    document.write('<br/>First number is less than the second number: ' +  
        (firstNumber < secondNumber));
```

```
document.write('<br/>First number is equal to the second number: ' +  
(firstNumber == secondNumber));  
</script>
```

In the code, each condition is evaluated to return a boolean value. The `alert()` function displays the boolean value as `true` or `false`.

10.16.4 Logical Operators

Logical operators are binary operators that perform logical operations on two operands. They belong to the category of relational operators, as they return a boolean value. Table 10.11 lists various logical operators and an example of each type, assuming that `x` is 2 and `y` is 2.

Logical Operator	Description	Example
<code>&&</code> (AND)	Returns true, if either of the operands are evaluated to true. If first operand evaluates to true, it will ignore the second operand	<code>(x == 2) && (y == 5)</code> Returns false
<code>!</code> (NOT)	Returns false, if the expression is true and vice-versa	<code>!(x == 3)</code> Returns true
<code> </code> (OR)	Returns true, if either of the operands are evaluated to true. If first operand evaluates to true, it will ignore the second operand	<code>(x == 2) (y == 5)</code> Returns true

Table 10.11: Logical Operators

Code Snippet 16 shows the script that uses logical `AND` operator to check whether the value of `name` and `age` variables are John and 23.

Code Snippet 16:

```
<script>  
var name = "John";  
var age = 23;  
alert('John\'s age is greater than or equal to 23 years : ' +  
((name=="John") && (age >= 23)));  
</script>
```

The code declares and initializes two variables namely, `name` and `age` to John and 23 respectively. In the `alert()` function, the logical `AND` operator checks whether the value of the `name` variable is John and the value of the `age` variable is 23. Here, both the expressions are true and therefore, the operator will return `true`, which will be displayed in the message box to the user.

10.16.5 Assignment Operators

Assignment operator assign the value of the right operand to the operand on the left by using the equal to operator (`=`).

The assignment operator is divided into two categories in JavaScript that is as follows:

- **Simple assignment operator** - Is the '=' operator which is used to assign a value or result of an expression to a variable. For example, `result = numOne + numTwo;`
- **Compound assignment operator** - Is formed by combining the simple assignment operator with the arithmetic operators. For example, `salary -= eval(salary * tax / 100);`

Table 10.12 demonstrates the use of assignment operator by assuming the value of the variable `numOne` as 6.

Expression	Description	Result
<code>numOne += 6;</code>	<code>numOne = numOne + 6</code>	<code>numOne = 12</code>
<code>numOne -= 6;</code>	<code>numOne = numOne - 6</code>	<code>numOne = 0</code>
<code>numOne *= 6;</code>	<code>numOne = numOne * 6</code>	<code>numOne = 36</code>
<code>numOne %= 6;</code>	<code>numOne = numOne % 6</code>	<code>numOne = 0</code>
<code>numOne /= 6;</code>	<code>numOne = numOne / 6</code>	<code>numOne = 1</code>

Table 10.12: Assignment Operator

10.16.6 Bitwise Operators

Bitwise operators represent their operands in bits (zeros and ones) and perform operations on them. However, they return standard decimal values.

Table 10.13 lists various bitwise operators along with their descriptions and an example of each type, assuming `a` is 9 (00001001) and `b` is 14 (00001110).

Bitwise Operators	Description	Example
& (Bitwise AND)	Compares two bits and returns 1 if both of them are 1 or else returns 0	<code>a & b</code> Returns 8 (00001000)
~ (Bitwise NOT)	Inverts each bit of the operand, changes its sign and subtracts by 1. It is a unary operator	<code>~a</code> Returns -10
(Bitwise OR)	Compares two bits and returns 1 if the corresponding bits of either or both the operands is 1	<code>a b</code> Returns 15 (00001111)
^ (Bitwise XOR)	Compares two bits and returns 1 if the corresponding bit of either, but not both the operands is 1	<code>a ^ b</code> Returns 7 (00000111)

Table 10.13: Bitwise Operators

Code Snippet 17 demonstrates the working of the bitwise AND and OR operator in JavaScript.

Code Snippet 17:

```
//(56 = 00111000 and 28 = 00011100)
alert ("56" + ' & ' + "28" + ' = ' + (56 & 28));
//(56 = 00111000 and 28 = 00011100)
alert ("56" + ' | ' + "28" + ' = ' + (56 | 28));
```

In the code, the bitwise AND operator performs the comparison operation on the corresponding bits of the two operands. It returns 1, if both the bits in that position are 1. The result of these comparisons is an 8-bit binary number, which is automatically converted into integer. This integer is displayed as the output which is 24.

Similarly, the bitwise OR operator performs the comparison operation on the corresponding bits of the two operands. It returns 1, if either of the bits or both the bits in that position is 1. The result of these comparisons is an 8-bit binary number, which is automatically converted into integer. This integer is displayed as the output which is 60.

Code Snippet 18 demonstrates the working of the bitwise XOR and NOT operators in JavaScript.

Code Snippet 18:

```
//(56 = 00111000 and 28 = 00011100)
alert ("56" + ' ^ ' + "28" + ' = ' + (56 ^ 28));
//(28 = 00011100)
alert ('~' + "28" + ' = ' + (~28));
```

In the code, the bitwise XOR operator performs the comparison operation on the corresponding bits of the two operands. It returns 1, if only 1 of the bits in that position is 1. The result of these comparisons is an 8-bit binary number, which is automatically converted into integer. This integer is displayed as the output that is 36.

Similarly, the bitwise NOT operator inverts each bit, which results in an 8-bit binary number. This binary number automatically converts into integer. This integer is displayed as the output which is -29.

10.16.7 Special Operators

There are some operators in JavaScript which do not belong to any of the categories of JavaScript operators. Such operators are referred to as the special operators.

Table 10.14 lists the most commonly used special operators in JavaScript.

Special Operator	Description
, (comma)	Combines multiple expressions into a single expression, operates on them in the left to right order and returns the value of the expression on the right
? : (conditional)	Operates on three operands where the result depends on a condition. It is also called as ternary operator and has the form condition, ? value1:value2. If the condition is true, the operator obtains value1 or else obtains value2

Special Operator	Description
typeof	Returns a string that indicates the type of the operand. The operand can be a string, variable, keyword, or an object

Table 10.14: Special Operators

Code Snippet 19 demonstrates the use of special operators to validate the age of a person for voting.

Code Snippet 19:

```
<script>
    var age = parseInt(prompt("Enter age", "Age"))
    status = ((typeof(age) == "number" && (age >= 18)) ? "eligible"
    : "not eligible";
    document.write('You are ' + age + ' years old, so you are '
    +status + ' to vote.');
</script>
```

In the code, the `prompt()` function accepts the value from the user. The value is converted into an integer and is stored in the `age` variable. The conditional operator specifies a condition before `?` symbol. The condition checks whether the value of the variable `age` is a number and whether it is greater than equal to 18. If both these expressions return `true`, the value `eligible` is assigned to the `status` variable. Otherwise, the value `not eligible` is assigned to the `status` variable. The `document.write()` function displays the final output as whether the user is eligible for voting or not eligible.

The output of the code will first show a prompt box in which a user enters the value. Assume that user enters 19 for the `age` variable. Figure 10.14 displays the output after the age has been given, indicating that the user is eligible for voting.

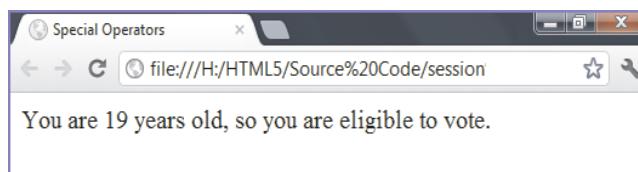


Figure 10.14: Output – User Eligible for Voting

10.16.8 Operator Precedence

Operators in JavaScript have certain priority levels based on which their execution sequence is determined. For example, the division operator (`/`) has a higher priority than the subtraction (`-`) operator. Therefore, the division operator will be carried out first, if an expression involves both these operators.

Further, an execution order is also defined for the operators within expression. This order is referred to as the associativity, which is either from left to right or vice-versa depending upon the operators.

Table 10.15 lists the precedence of the operators from the highest to the lowest and their associativity.

Precedence Order	Operator	Description	Associativity
1	()	Parentheses	Left to Right
2	++, --	Post-increment and Post-decrement operators	Not Applicable
3	typeof, ++, --, -, ~, !	Pre-increment and Pre-decrement operators, Logical NOT, Bitwise NOT, and Unary negation	Right to Left
4	*, /, -	Multiplication, Division, and Modulo	Left to Right
5	+, -	Addition and Subtraction	Left to Right
6	<, <=, >, >=	Less than, Less than or equal, Greater than, and Greater than or equal	Left to Right
7	==, ===, !=, !==	Equal to, Strict equal to, Not equal to, and Strict not equal to	Left to Right
8	&, , ^, &&,	Bitwise AND, Bitwise OR, Bitwise XOR, Logical AND, and Logical OR	Left to Right
9	? :	Conditional operator	Right to Left
10	=, +=, -=, *=, /=, %=	Assignment operators	Right to Left
11	,	Comma	Left to Right

Table 10.15: Precedence of Operators

Code Snippet 20 demonstrates the evaluation of an expression based on its operator's precedence.

Code Snippet 20:

```

<script>
    var numOne = 96, numTwo = 45, numThree = 200;
    var result;
    result = 2 * (numThree - numOne + numTwo);
    alert('The result is: ' + result);
</script>

```

In the code, operators such as *, -, and + are being used to form the expression. According to the rules of operator precedence, parentheses alter the order of evaluation.

Thus, the expression within parentheses is evaluated first and its result is used to evaluate the remaining expression. Since, the + and - operators have same precedence, therefore, the expression within parentheses is evaluated from left to right. Then, the outcome of the expression is multiplied with the value 2 and assigned to the variable **result**.

10.17 Regular Expressions

A regular expression is a pattern that is composed of set of strings, which is to be matched to a particular textual content. For example, you can specify a pattern for US postal code that the code will not contain more than five digits. When the user enters the postal code, the digits entered by the user will be verified against the pattern to ensure that the postal code is valid.

Regular expressions allow handling textual data effectively, as it allows searching and replacing strings. They allow handling complex manipulation and validation that could otherwise be implemented through lengthy scripts.

In JavaScript, there are two ways to create regular expressions which are as follows:

→ Literal Syntax

A literal refers to a static value. Therefore, a literal syntax allows specifying a fixed pattern, which is stored in a variable. This method of specifying patterns is useful when the Web page designer knows the pattern at the time of scripting.

The syntax to specify the literal syntax is as follows:

Syntax:

```
var variable_name = /regular_expression_pattern/;
```

where,

regular_expression_pattern: Is a string pattern.

variable_name: Is the name of the variable which stores the pattern.

Code Snippet 21 shows the use of literal syntax to create a regular expression pattern.

Code Snippet 21:

```
<script>
    var ageFormat = /^\\d{2}$/;
</script>
```

In the code, to match a 2-digit number, the **ageFormat** variable is declared. The variable stores the literal pattern. The pattern starts and ends with the forward slashes. The ^ character denotes the starting position of a string, \d{2} represents two digits, and \$ character denotes the end of a string. This means that the string must contain only two digits to represent a valid age value.

→ RegExp() Constructor

The **RegExp()** constructor is useful when the Web page designer does not know the pattern at the time of scripting. This means that the method dynamically constructs a regular expression when the script is executed. The **RegExp()** constructor is a function that returns a reference to the built-in **RegExp** object.

The syntax to use the **RegExp()** constructor is as follows:

Syntax:

```
var variable_name = new RegExp("regular_expression_pattern", "flag");
```

where,

`new`: Is a keyword and a special operator that creates the `RegExp` object.

`variable_name`: Is the name of the variable which refers to the `RegExp` object that holds the pattern.

`flag`: Is a letter that specifies whether to search for patterns in the complete string and to consider the casing of characters in the string.

Code Snippet 22 shows the use to `RegExp ()` constructor to create a regular expression pattern.

Code Snippet 22:

```
<script>
    var nameCheck = new RegExp ("^Jo");
</script>
```

In the code, the `RegExp ()` constructor creates a search pattern at runtime. The pattern, "`^Jo`" is matched with the specified string to check, if it starts with "Jo" at the first position.

10.17.1 *RegExp Methods and Properties*

The `RegExp` object supports methods that are used for searching the pattern in a string. These methods are as follows:

- **test(string)** – Tests a string for matching a pattern and returns a boolean value of `true` or `false`. The boolean value indicates whether the pattern exists in the string. This method is commonly used for validation.
- **exec(string)** – Executes a string to search the matching pattern within it. The method returns a null value, if pattern is not found. In case of multiple matches, it returns the matched result set.

Apart from these, `RegExp` object also supports properties that are used to get information regarding the string.

Table 10.16 lists the properties of the `RegExp` object.

Property	Description
<code>\$n</code>	Represents the number from 1 to 9. It stores the recently handled parts of a parenthesized pattern of a regular expression For example, if the pattern for the recent search was <code>/ (w+) (\s+) (w+) /</code> and the string found was "Hi Mary", the value of <code>RegExp. \$1</code> would contain the value Hi
<code>aif</code>	Indicates whether the given regular expression contain a <code>g</code> flag. The <code>g</code> flag specifies that all the occurrences of a pattern will be searched globally, instead of just searching for the first occurrence. For example, <code>/no/g</code> matches both "no"s in "No health no life"
<code>aifc</code>	Indicates whether the given regular expression contains an <code>i</code> flag

Property	Description
aiff	Stores the location of the starting character of the last match found in the string. In case of no match, the value of the property is -1
asc	Stores the copy of the pattern

Table 10.16: Properties of RegExp Object

Code Snippet 23 demonstrates the script to verify whether the entered zip code is valid or not using a regular expression.

Code Snippet 23:

```
<script>
var zipcodepattern = /^d{5}$/;
var zipcode = zipcodepattern.exec(prompt('Enter ZIP Code:'));
if(zipcode != null) {
    alert('Valid ZIP Code.');
    alert('Regular Expression Pattern: ' + zipcodepattern.source);
}
else {
    alert('Invalid ZIP Code - Format xxxxx.');
}
</script>
```

In the code, **zipcodepattern** variable stores a pattern that states that the search string must contain only five digits. The zip code is accepted from the user and the pattern is matched with the code using the `exec()` method. The `if` condition checks whether the entered zip code is not `null`. If it is not `null`, the `Valid ZIP Code` message and the pattern is displayed or else the `Invalid ZIP Code – Format xxxxx` message is displayed.

10.17.2 Categories of Pattern Matching

There are different categories of pattern matching character that are required to create a regular expression pattern.

These categories are as follows:

- ➔ Position Matching
- ➔ Character Classes
- ➔ Repetition
- ➔ Alternation and Grouping
- ➔ Back Reference

The brief description of these categories is as follows:

→ **Position Matching**

Characters or symbols in this category allow matching a substring that exists at a specific position within a string.

Table 10.17 lists various position matching symbols.

Symbol	Description	Example
^	Denotes the start of a string	/^Good/ matches "Good" in "Good night", but not in "A Good Eyesight"
\$	Denotes the end of a string	/art\$/ matches "art" in "Cart", but not in "artist"
\b	Matches a word boundary. A word boundary includes the position between a word and the space	/ry\b/ matches "ry" in "She is very good"
\B	Matches a non-word boundary	/\Ban/ matches "an" in "operand", but not in "anomaly"

Table 10.17: Position Matching Symbols

→ **Character Classes**

Characters or symbols in this category are combined to form character classes for specifying patterns. These classes are formed by placing a set of characters within the square brackets. For example, the / [a-zA-Z0-9] / pattern matches all alphabets and digits.

Table 10.18 lists various character classes symbols.

Symbol	Description	Example
[xyz]	Matches one of the characters specified within the character set	/[BC]RT/ Matches "BRT" and "CRT" but, not "RT", since the leading letter "R" is not specified in the set
[^xyz]	Matches one of the characters not specified within the character set	/[^BC]RT/ Matches "RT", but not "BRT" or "CRT"
.	Denotes a character except for the new line and line terminator	/s.t/ Matches "sat", "sit", "set", and so on
\w	Matches alphabets and digits along with the underscore	/\w/ Matches "600" in "600%"
\W	Matches a non-word character	/\W/ Matches "%" in "800%"

Symbol	Description	Example
\d	Matches a digit between 0 to 9	/\d/ Matches "4" in "A4"
\D	Searches for a non-digit	/\D/ Matches "ID" in "ID 2246"

Table 10.18: Character Classes Symbols

Code Snippet 24 uses the position matching symbols, escape sequence characters, and character classes to form a regular expression.

Code Snippet 24:

```
<script>
  // To match a string ending with "ing"
  var stringEnd=/ing$/;
  // To match single digit
  var num = /\d/;
</script>
```

The code declares and initializes the `stringEnd` and `num` variables. The pattern for the `stringEnd` variable specifies that the search string must end with letters ing. The \$ character denotes the end position of the string. The pattern for the `num` variable specifies that the search string must have at least one digit within it.

→ Repetition

Characters or symbols in this category allow matching characters that reappear frequently in a string.

Table 10.19 lists various repetition matching symbols.

Symbol	Description	Example
{x}	Matches x number of occurrences of a regular expression	/\d{6}/ Matches exactly 6 digits
{x, }	Matches either x or additional number of occurrences of a regular expression	/\s{4, }/ Matches minimum 4 whitespace characters
{x,y}	Matches minimum x to maximum y occurrences of a regular expression	/\d{6,8}/ Matches minimum 6 to maximum 8 digits
?	Matches minimum zero to maximum one occurrences of a regular expression	/l\s?m/ Matches "lm" or "l m"

Symbol	Description	Example
*	Matches minimum zero to multiple occurrences of a regular expression	/im*/ Matches "i" in "Ice" and "imm" in "immaculate", but nothing in "good"
+	Matches one or multiple number of occurrences of a regular expression	/le+d/ Matches both "led" and "lead"

Table 10.19: Repetition Matching Symbols

→ Alternation and Grouping

Characters or symbols in this category allow grouping characters as an individual entity or adding the 'OR' logic for pattern matching.

Table 10.20 lists various alternation and grouping character symbols.

Symbol	Description	Example
()	Organizes characters together in a group to specify a set of characters in a string	/ (xyz) + (uvw) / Matches one or more number of occurrences of "xyz" followed by one occurrence of "uvw"
	Combines sets of characters into a single regular expression and then, matches any of the character set	/ (xy) (uv) (st) / Matches "xy" or "uv" or "st"

Table 10.20: Alternating and Grouping Matching

→ Back References

Characters or symbols in this category allow referring back to a sub-expression in the same regular expression. This is useful when matching the remaining sub-expression of a regular expression is based upon the result of matching the previous sub-expression.

Table 10.21 lists the back reference matching symbol.

Symbol	Description	Example
() \n	Matches a parenthesized set within the pattern, where n is the number of the parenthesized set to the left	/ (\w+) \s+ \1 / Matches any word occurring twice in a line, such as "hello hello." The \1 specifies that the word following the space should match the string, which already matched the pattern in the parentheses to the left of the pattern. To refer to more than one set of parentheses in the pattern, you would use \2 or \3 to match the appropriate parenthesized clauses to the left. You can have maximum nine back references in the pattern

Table 10.21: Back References

10.18 Decision-making Statements

Statements are referred to as a logical collection of variables, operators, and keywords that perform a specific action to fulfill a required task. For example, the line of code that declares a variable is a statement. Statements help you build a logical flow of the script. In JavaScript, a statement ends with a semicolon. JavaScript is written with multiple statements, wherein the related statements are grouped together. Such a group of statements is referred to as a block of code and the statements within it are enclosed in curly braces.

Decision-making statements allow implementing logical decisions for executing different blocks to obtain the desired output. They execute a block of statements depending upon a Boolean condition. This condition is an expression that returns either `true` or `false`.

JavaScript supports four decision-making statements which are as follows:

- ➔ `if`
- ➔ `if-else`
- ➔ `if-else if`
- ➔ `switch`

10.18.1 if Statement

The `if` statement executes a block of statements based on a logical Boolean condition. If this condition is `true`, the block following the `if` statement is executed. If the condition is `false`, the block after the `if` statement is not executed and the immediate statement after the block is executed.

Figure 10.15 shows the flow of execution for the '`if`' statement.

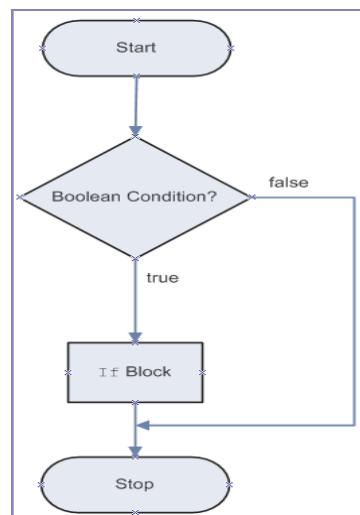


Figure 10.15: Flow of Execution – if Statement

The syntax to use the `if` statement is as follows:

Syntax:

```
if (condition)
{
```

```
// one or more statements;
}
```

where,

condition: Is the boolean expression.

statements: Consists of instructions to be executed when the boolean expression is true.

Code Snippet 25 checks whether the quantity value is a number and whether it is greater than 0 using the if statement.

Code Snippet 25:

```
<script>
    var quantity = prompt('Enter quantity of product:', 0);
    if(quantity < 0 || isNaN(quantity)) {
        alert('Please enter a positive number.');
        alert('Please enter a positive number.');
    }
</script>
```

The code accepts a quantity value from the user using the `prompt()` function and stores it in the `quantity` variable. The `if` statement is executed and the value of variable `quantity` is checked whether it is less than 0 and whether it is not a number. If value provided by the user is less than 0 or is a value other than a number, the condition evaluates to `true` and the output Please enter a positive number is displayed to the user.

10.18.2 if-else Statement

The `if` statement specifies a block of statement to be executed when the condition in the `if` statement is true. However, sometimes it is required to define a block of statements to be executed when a condition is evaluated to false. This is done using the `if-else` statement.

The `if-else` statement begins with the `if` block, which is followed by the `else` block. The `else` block begins with the `else` keyword followed by a block of statements to be executed upon the `false` condition.

The syntax to use the `if-else` statement is as follows:

Syntax:

```
if (condition) {
    // one or more statements;
}
else {
    // one or more statements;
}
```

Code Snippet 26 performs the division operation and validates that the divisor is not equal to 0 using the

if-else statement.

Code Snippet 26:

```
<script>
var firstNumber=prompt('Enter first number:',0);
var secondNumber=prompt('Enter second number',0);
var result=0;
if (secondNumber==0) {
    alert('ERROR Message: Cannot divide by zero.');
}
else {
    result=firstNumber/secondNumber;
    alert("Result: " + result);
}
</script>
```

The code accepts two numbers for the division operation and stores them in the variables `firstNumber` and `secondNumber` respectively. The `if` statement checks whether the value of the variable `secondNumber` is 0. If it is 0, the `alert()` function displays the error message to the user. If the value is not 0, the `else` block is executed, which performs the division operation. The quotient is stored in the `result` variable and is displayed to the user.

10.18.3 if-else if statement

The `if-else if` statements allow you to check multiple conditions and specify a different block to be executed for each condition. The flow of these statements begins with the `if` statement followed by multiple `else if` statements and finally by an optional `else` block. The entry point of execution in these statements begins with the `if` statement. If the condition in the `if` statement is false, the condition in the immediate `else if` statement is evaluated.

The `if-else if` statements are also referred to as the `if-else if` ladder.

The syntax to use the `if-else if` statements are as follows:

Syntax:

```
if (condition) {
    // one or more statements;
}
else if (condition)
{
    // one or more statements;
}
else {
    // one or more statements;
}
```

Code Snippet 27 displays grades according to percentage value entered by the user using the `if-else if` statements.

Code Snippet 27:

```
<script>
    var percentage = prompt('Enter percentage:', 0);
    if (percentage >= 60)  {
        alert ('You have obtained the A grade.');
    }
    else if (percentage >= 35 && percentage < 60) {
        alert ('You have obtained the B class.');
    }
    else {
        alert ('You have failed');
    }
</script>
```

The code accepts the percentage value from the user and stores it in the `percentage` variable. The `if` statement checks whether the value of the `percentage` variable is greater than or equal to 60. If this is `true`, the user has obtained the `A` grade. If the condition is `false`, the execution control is passed to the `else if` block. Here, the value of the `percentage` variable is checked as to whether it is greater than or equal to 35 and less than 60. If this is `true`, the user has obtained the `B` grade. If the condition is `false`, the `else` block is executed.

10.18.4 Nested-if Statement

The nested-if statements comprises multiple `if` statements within an `if` statement. The flow of the nested-if statements starts with the `if` statement, which is referred to as the outer `if` statement. This outer `if` statement consists of multiple `if` statements, which are referred to as the inner `if` statements.

The inner `if` statements are executed only if the condition in the outer `if` statement is `true`. Further, each of the inner `if` statements is executed, but only if the condition in its previous inner `if` statement is `true`.

The syntax to use the nested `if` statements.

Syntax:

```
if (condition)
{
    // one or more statements;
    if (condition)
    {
        // one or more statements;
        if (condition)
        {
            // one or more statements;
        }
    }
}
```

```
        }
    }
}
```

Code Snippet 28 validates the username and password using the nested-if statements.

Code Snippet 28:

```
<script>
var username=prompt ('Enter Username:');
var password=prompt ('Enter Password:');
if (username != "" && password != "") {
if (username == "admin" && password == "admin123") {
alert('Login Successful');
}
else { alert ('Login Failed'); }
}
</script>
```

The code accepts the username and password and stores them in the **username** and **password** variables. The **if** statement checks whether the values of both the variables are not empty. If they are not empty, the inner if statement is executed. The inner if statement checks whether the value of the **username** variable is admin and the value of the **password** variable is admin123. If this condition is true, the Login Successful message is displayed to the user. If the condition is false, the **else** block is executed.

10.18.5 switch-case Statement

A program becomes quite difficult to understand when there are multiple **if** statements. To simplify coding and to avoid using multiple **if** statements, **switch-case** statement can be used as a different approach to code the same logic. The **switch-case** statement allows comparing a variable or expression with multiple values.

The syntax to use the **switch-case** statement is as follows:

Syntax:

```
switch(expression/variable) {
    case value1:
        // statements;
        break;
    case value2:
        // statements;
        break;
    . . .
    case valueN:
        // statements;
        break;
```

```
default:  
    // default statement  
}
```

where,

switch: Executes a specific case statement that holds the value of the expression or the variable.

case: A value and a colon follow the `case` keyword. The block of a specific case statement is executed when the value of switch expression and the case value are the same. Each case block must end with the `break` keyword.

break: Passes the execution control to the statement existing immediately out of the `switch-case` statement. If there is no `break` statement, the next case statement is executed.

default: The execution control passes to the default block when none of the case values matches with the switch expression. The default block is the same as the `else` block of the `if-else if` statements.

Code Snippet 29 displays the salary of an employee according to the designation by using the `switch-case` statement.

Code Snippet 29:

```
<script>  
var designation=prompt('Enter designation:');  
switch (designation) {  
case 'Manager':  
    alert ('Salary: $21000');  
    break;  
case 'Developer':  
    alert ('Salary: $16000');  
    break;  
default:  
    alert ('Enter proper designation.');//  
    break;  
}  
</script>
```

The code uses the variable `designation` to store the designation of an employee, which is accepted from the user. The `switch` statement takes the value of the `designation` variable and this value is matched with different `case` statements. If the value matches, the particular `case` block is executed, which displays the respective salary. If none of the case values matches with the `switch` variable, the `default` block is executed.

10.19 Introduction to Loops

Consider a scenario where you want to accept and display ten numbers to the user. Instead of writing the same lines of code again and again for 10 times, you can use loops.

Loops allow you to execute a single statement or a block of statements multiple times. They are widely used when you want to display a series of numbers and accept repetitive input. A loop construct consists of a condition that instructs the compiler the number of times a specific block of code will be executed.

JavaScript supports three types of loops that are as follows:

- while Loop
- for Loop
- do-while Loop

If the condition is not specified within the construct, the loop continues infinitely. Such, loop constructs are referred to as infinite loops.

10.20 while Loop

The `while` loop executes a block of code as long as the given condition remains `true`.

The `while` loop begins with the `while` keyword, which is followed by parentheses containing a boolean condition. If this condition returns `true`, the block of statements within the `while` loop are executed. After each iteration, the program control is transferred back to the `while` statement, where the condition is again checked for another round of execution. This process is continued till the specified condition becomes `false`. Once the condition becomes `false`, the `while` statement stops the execution of loop and transfers the control to next statement appearing after the block.

Figure 10.16 shows the flow of execution - `while` loop.

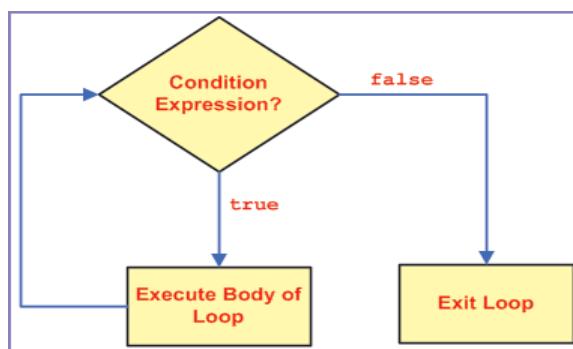


Figure 10.16: Flow of Execution - `while` Loop

The syntax for the `while` loop is as follows:

Syntax:

```
while (condition)
{
// statements;
}
```

where,

condition: Is a boolean expression.

Code Snippet 30 displays the sum of numbers from 1 to 10 by using the `while` loop.

Code Snippet 30:

```
<script>
var i = 0;
var sum = 0;
while (i<=10) {
    sum = sum + i;
    i = i + 1;
}
alert ('Sum of first 10 numbers: ' + sum);
</script>
```

The code declares two variables, `i` and `sum`, which are initialized to value 0. The variable, `i`, is a counter variable, whose value increases for each execution of loop. The condition in the `while` loop checks that the value of the counter variable, `i`, is less than or equal to 10. If this condition is `true`, the value of the `sum` variable is added to the value of `i` variable. The value of the variable `i` is incremented by 1. Then, the program control is passed to the `while` statement to check the condition again. When the value of `i` becomes 11, the `while` loop terminates as the loop condition becomes `false`.

Figure 10.17 shows the output.



Figure 10.17: Output

10.21 for Loop

The `for` loop is similar to the `while` loop in functionality. It executes the statements within the loop as long as the given condition is `true`. Unlike the `while` loop, the `for` loop specifies the loop control statements at the top instead in the body of the loop.

The `for` loop begins with the `for` keyword, which is followed by parentheses containing three expressions, each of which are separated by a semicolon. The three expressions are referred to as **initialization expression**, **condition expression**, and **increment/decrement expression** respectively. These three expressions are optional.

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The syntax for the `for` loop is as follows:

Syntax:

```
for (initialization; condition; increment/decrement)
{
// statements;
}
```

where,

`initialization`: Initializes the variable(s) that will be used in the condition.

`condition`: Comprises the condition that is checked, before the statements in the loop are executed.

`increment/decrement`: Comprises the statement that changes the value of the variable(s) on each successful execution of the loop to ensure that the condition specified in the condition section is reached. The increment and decrement operators, such as `++`, `--`, and shortcut operators: `+=` or `-=` are used in this section.

Figure 10.18 shows the `for` loop.

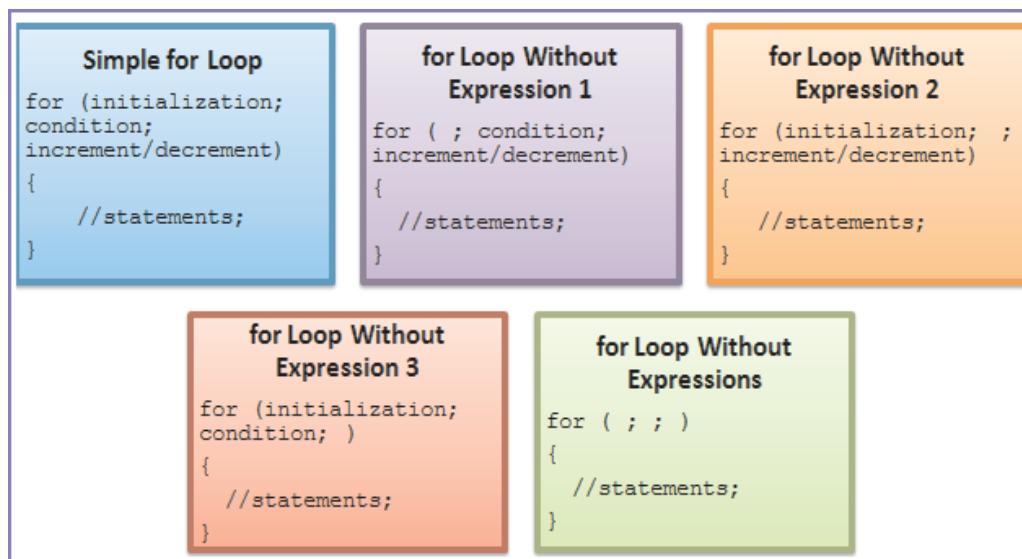


Figure 10.18: for Loop

Code Snippet 31 demonstrates the script that accepts a number from the user and displays the first ten multiples of that number.

Code Snippet 31:

```
<script>  
var inputNum=prompt('Enter any number:');  
var result=0;  
document.write ('Multiples of: '+inputNum+'<br />');  
for (vari=1; i<=10; i++) {  
    result = inputNum * i ;
```

```
document.write(inputNum + ' * ' + i + ' = ' + result + '<br />');

}

</script>
```

In the code, a variable, `inputNum`, is created and initialized to the value specified by the user in the prompt box. The `for` loop declares a variable, `i`, and initializes it to the value 1. If the condition is `true`, the number specified by the user is multiplied to the value of `i` variable and the result is appended to the `result` variable. The program control is again passed to `for` statement, where the value of `i` is incremented. The incremented value is again checked with the specified condition and it is multiplied to the number specified by the user. This process continues till the value of `i` becomes 11.

Figure 10.19 shows the multiples of a number.

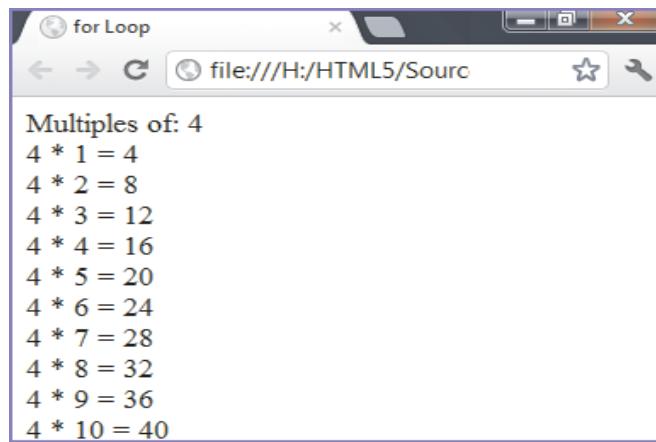


Figure 10.19: Multiples of a Number

10.22 do-while Loop

The `do-while` loop is similar to the `while` loop. This is because both the `do-while` and `while` loops execute until the condition becomes `false`. However, the `do-while` loop differs by executing the body of the loop at least once before evaluating the condition. Thus, even if the condition is `false`, the `do-while` loop executes at least once.

The `do-while` loop starts with the `do` keyword and is followed by a block of statements. At the end of the block, the `while` keyword is specified that is followed parentheses containing the condition. When the specified condition returns `false`, the block of statements after the `do` keyword are ignored and the next statement following the `while` statement is executed.

Figure 10.20 shows the `do-while` loop.

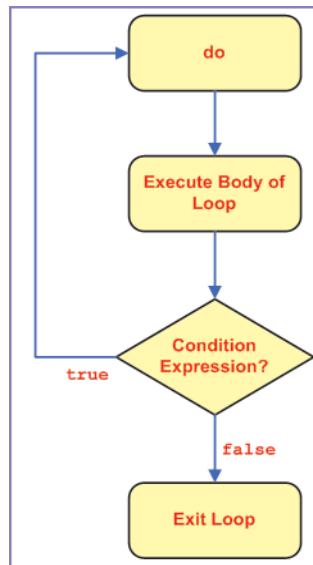


Figure 10.20: do-while Loop

The syntax for the do-while loop is as follows:

Syntax:

```
do
{
...
statements;
...
}while(condition);
```

where,

condition: Is a boolean expression.

Code Snippet 32 demonstrates the script to accept the capital of United States from the user using the do-while loop.

Code Snippet 32:

```
<script>
var answer = '';
do {
    answer=prompt('Capital of United States:', '');
}while(answer!='Washington');
alert('Capital of United States: ' + answer);
</script>
```

The code declares a variable, `answer`, which stores the string entered by the user. The `do` block displays a prompt box without checking any condition. The prompt box accepts the capital of United States and

stores this string in the variable, **answer**. The condition is specified in the **while** block that checks, if the user has entered the string **washington**. If this condition is **true**, prompt box is closed; else the prompt box is again displayed to accept the user input.

10.23 break Statement

The **break** statement can be used with decision-making statements, such as switch-case and loop constructs, such as **for** and **while** loops. The **break** statement is denoted by using the **break** keyword. It is used to exit the loop without evaluating the specified condition. Then, the control is passed to the next statement immediately after the loop.

Figure 10.21 shows the flow of execution of the **break** statement.

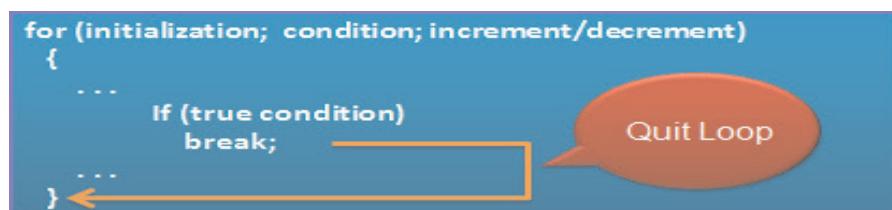


Figure 10.21: Flow of Execution - break Statement

Code Snippet 33 demonstrates the script that accepts a number from the user and determines if it is a prime number or not.

Code Snippet 33:

```
<script>
var inputNum=parseInt(prompt('Enter number: ',''));
var num = 2;
while(num<=inputNum-1) {
    if(inputNum % num == 0)    {
        alert(inputNum + ' is not a Prime Number');
        break;
    }
    num++;
}
if(num==inputNum) {
    alert (inputNum + ' is a Prime Number');
}
</script>
```

The code creates a variable, **inputNum**, which is initialized to the number entered by the user.

The variable **num** is declared and initialized to 2. If the **while** condition returns **true**, the inner **if** statement is checked. If this condition returns **true**, an alert box is displayed stating that the number is not a prime number. The **break** statement is used to exit the entire **while** loop. If the condition evaluates to **false**, the program control is passed to **if** statement outside the **while** loop.

Figure 10.22 shows the output of the prime number on accepting number, 6 from the user in the prompt box.

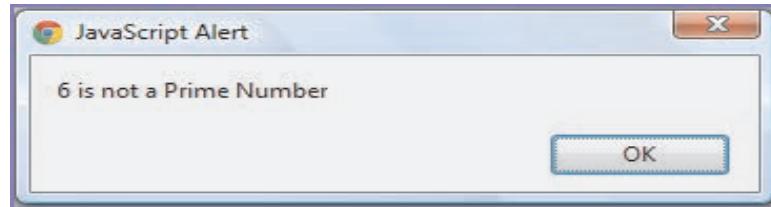


Figure 10.22: Output - Prime Number

10.24 continue Statement

The `continue` statement is mostly used in the loop constructs. The `continue` statement is denoted by the `continue` keyword. It is used to terminate the current execution of the loop and `continue` with the next repetition by returning the control to the beginning of the loop. This means, the `continue` statement will not terminate the loop entirely, but terminates the current execution.

Figure 10.23 shows the flow of execution of the `continue` statement.



Figure 10.23: continue Statement

Code Snippet 34 displays even numbers from 0 to 15.

Code Snippet 34:

```
<script>
var result = '';
for (var i = 0; i <= 15; i++) {
    if ((i%2) != 0) {
        continue;
    }
    result = result + i + '\n';
}
alert ('Even Numbers:\n' + result);
</script>
```

The code declares a variable, `i`, in the `for` loop definition and initializes it to value 1. When the value of `i` is divided by zero, the `if` statement checks whether the remainder is equal to zero. If the remainder

is zero, the value of `i` is displayed as the value is an even number. If the remainder is not equal to 0, the `continue` statement is executed. It transfers the program control to the beginning of the `for` loop.

Figure 10.24 shows the output of the `continue` statement.

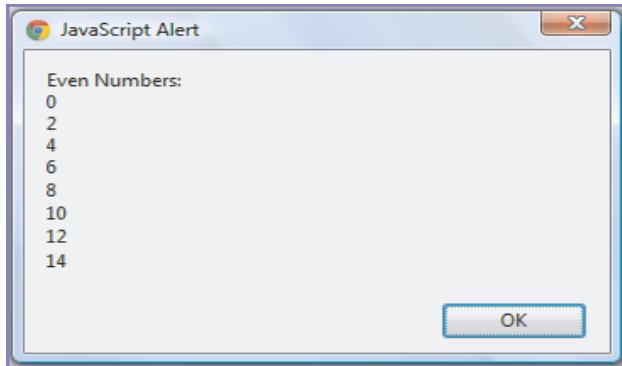


Figure 10.24: Output – `continue` Statement

10.25 Arrays

Consider a scenario where you want to store the names of 100 employees within an IT department. This can be done by creating 100 variables and storing the names. However, keeping track of 100 variables is a tedious task and it results in inefficient memory utilization. The solution to this problem is to create an array variable to store the names of 100 employees.

Figure 10.25 shows the effective usage of memory achieved using an array.

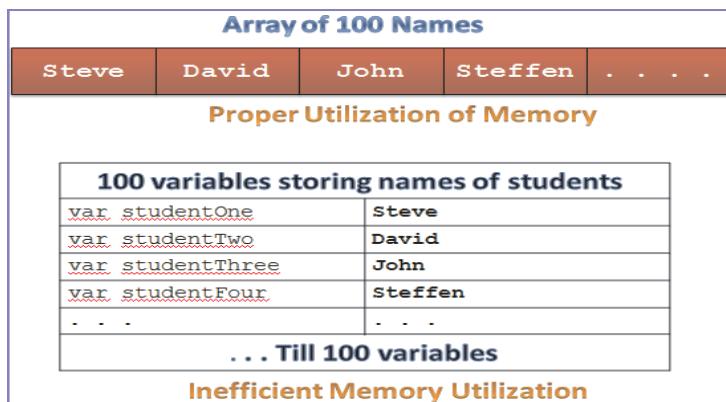


Figure 10.25: Memory Utilization Using an Array

An array is a collection of values stored in adjacent memory locations. These array values are referenced using a common array name. The values of an array variable must be of the same data type. These values that are also referred to as elements and can be accessed by using subscript or index numbers. The subscript number determines the position of an element in an array list.

10.25.1 Single-dimensional Array

In a single-dimensional array, the elements are stored in a single row in the allocated memory.

Figure 10.26 shows the allocation of single-dimensional array.

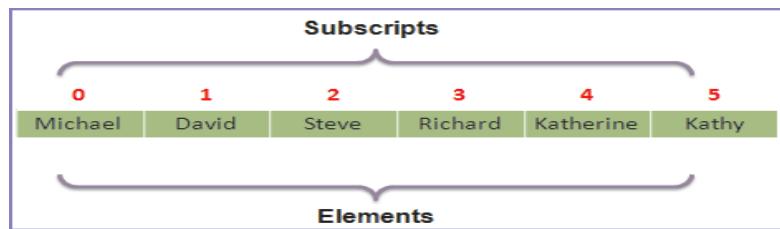


Figure 10.26: Single-dimensional Array

As shown in Figure 10.26, the first array element has the index number zero and the last array element has an index number one less than the total number of elements. This arrangement helps in efficient storage of data. In addition, it also helps to sort data easily and track the data length. The array variable can be created using the `Array` object and `new` keyword along with the size of the array element.

The syntax to declare and initialize a single-dimensional array is as follows:

Syntax:

```
var variable_name = new Array(size); //Declaration  
variable_name[index] = 'value';
```

where,

`variable_name`: Is the name of the variable.

`size`: Is the number of elements to be declared in the array.

`index`: Is the index position.

Code Snippet 35 shows different ways to declare and initialize a single-dimensional array.

Code Snippet 35:

```
<script>  
    //Declaration using Array Object and then Initialization  
    var marital_status = new Array(3);  
    marital_status[0] = 'Single';  
    marital_status[1] = 'Married';  
    marital_status[2] = 'Divorced';  
    //Declaration and Initialization  
    var marital_status = new Array('Single', 'Married', 'Divorced');  
    //Declaration and Initialization Without Array  
    var marital_status = ['Single', 'Married', 'Divorced'];  
</script>
```

10.25.2 Accessing Single-dimensional Arrays

Array elements can be accessed by using the array name followed by the index number specified in square brackets.

→ **Access Array Elements Without Loops**

An array element can be accessed without using loops by specifying the array name followed by the square brackets containing the index number.

Code Snippet 36 demonstrates a script that stores and displays names of the students using a single-dimensional array.

Code Snippet 36:

```
<script>
var names = newArray ("John", "David", "Kevin");
alert ('List of Student Names:\n' + names[0] + ', ' + ' ' + names[1] + ', ' + ' ' +
names[2]);
</script>
```

In the code, `var names = newArray ("John", "David", "Kevin");` declares and initializes an array. The `names[0]` accesses the first array element which is John. The `names[1]` accesses the second array element which is David. The `names[2]` accesses the third array element, which is Kevin. Figure 10.27 displays the names of the students.

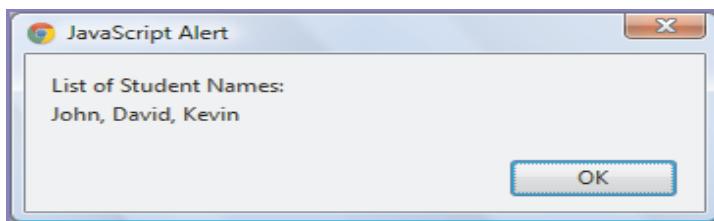


Figure 10.27: Output – Single-dimensional Array

→ **Access Array Elements With Loops**

JavaScript allows you to access array elements by using different loops. Thus, you can access each array element by putting a counter variable of the loop as the index of an element. However, this requires the count of the elements in an array. So, the `length` property can be used to determine the number of elements in an array.

Code Snippet 37 demonstrates the script that creates an array to accept the marks of five subjects and display the average.

Code Snippet 37:

```
<script>
var sum = 0;
var marks = newArray(5);
for (var i=0; i<marks.length; i++) {
    marks[i] = parseInt(prompt('Enter Marks:', ''));
    sum = sum + marks[i];
}

```

```
        alert ('Average of Marks: ' + (sum/marks.length));  
</script>
```

In the code, `var marks = new Array(5);` declares an array of size 5. It displays a prompt box that accepts the marks for a subject in each iteration. Then, the code calculates and displays the average marks.

Figure 10.28 displays the average of the marks, 90, 75, 85, 95, and 82 accepted from the user in the prompt box.

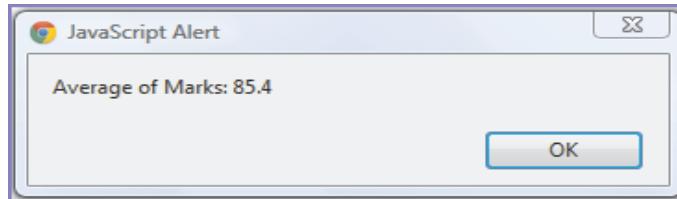


Figure 10.28: Average Marks of Five Subjects

10.25.3 Multi-dimensional Array

Consider a scenario to store the employee IDs of 100 employees and their salary structure. The salary structure will include the basic salary, allowances, HRA, and the total gross salary. Now, if a single-dimensional array is used, then two separate arrays must be created for storing employee IDs and salaries. However, using a multi-dimensional array, both IDs and salaries are stored in just one array.

A multi-dimensional array stores a combination of values of a single type in two or more dimensions. These dimensions are represented as rows and columns similar to those of a Microsoft Excel sheet. A two-dimensional array is an example of the multi-dimensional array.

Figure 10.29 shows the representation of a multi-dimensional array.

Employee Salaries →	0 BASIC	1 HRA	2 ALLOWANCE	3 TOTAL
0	14350	10500	1500	26350
1	34350	4050	1000	39400
2	6150	4500	3250	13900
3	4920	4500	2250	11670
4	12300	9000	2000	23300

Figure 10.29: Multi-dimensional Array

A two-dimensional array is an array of arrays. This means, for a two-dimensional array, first a main array is declared and then, an array is created for each element of the main array.

The syntax to declare a two-dimensional array is as follows:

Syntax:

```
var variable_name = new Array(size); //Declaration
```

```
variable_name[index] = new Array('value1','value2'...);
```

where,

variable_name : Is the name of the array.

index : Is the index position.

value1 : Is the value at the first column.

value2 : Is the value at the second column.

Figure 10.30 shows the declaration of a two-dimensional array.

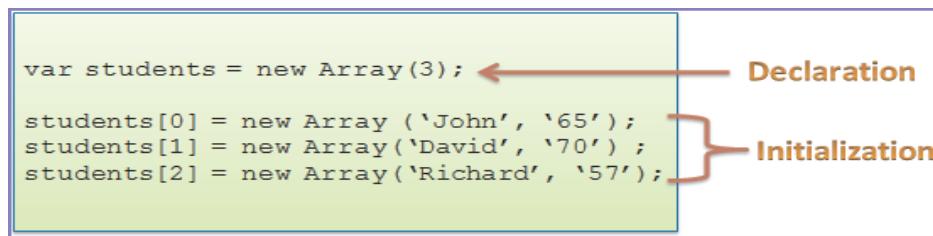


Figure 10.30: Declaration of Two-dimensional Array

10.25.4 Accessing Two-dimensional Arrays

Multi-dimensional arrays can be accessed by using the index of main array variable along with index of sub-array.

→ Access Array Elements Without Loops

Code Snippet 38 creates a two-dimensional array that displays the employee details.

Code Snippet 38:

```
<script>
var employees = new Array(3);
employees[0] = new Array('John', '25', 'New Jersey');
employees[1] = new Array('David', '21', 'California');
document.write('<H3>Employee Details</H3>');
document.write('<P><B>Name:</B>' + employees[0][0] + '</P>');
document.write('<P><B>Location:</B>' + employees[0][2] + '</P>');
document.write('<P><B>Name:</B>' + employees[1][0] + '</P>');
document.write('<P><B>Location:</B>' + employees[1][2] + '</P>');
</script>
```

In the code, `var employees = new Array(3)` creates an array of size 3. The declaration `employees[0] = new Array('John', '23', 'New Jersey')` creates an array at the 0th row of the `employees` array. Similarly, `employees[1] = new Array('David', '21', 'California')` creates an array at the first row of the `employees` array.

Figure 10.31 displays the employee details.



Figure 10.31: Output - Employee Details

→ Access Array Elements With Loops

Code Snippet 39 creates a two-dimensional array to display the product details.

Code Snippet 39:

```
<script>
var products = newArray(2);
products[0] = newArray('Monitor', '236.75');
products[1] = newArray('Keyboard', '45.50');
document.write('<TABLE border=1><TR><TH>Name</TH><TH>
Price</TH></TR>');
for(var i=0; i<products.length; i++) {
    document.write('<TR>');
    for(var j=0; j<products[i].length; j++) {
        document.write('<TD>' + products[i][j] + '</TD>');
    }
    document.write('</TR>');
}
document.write('</TABLE>');
</script>
```

In the code, `products[0] = newArray('Monitor', '236.75')` creates an array at the 0th row of the `products` array. Similarly, `products[1] = newArray('Keyboard', '45.50')` creates an array at the first row of the `products` array. The condition, `i < products.length`, specifies that the counter variable `i` should be less than the number of rows in the array variable, `products`. For each row in the array, the condition, `j < products[i].length` specifies that the counter variable `j`, should be less than the number of columns specified the `i`th row of the array variable, `products`. Finally, `document.write("<TD>" + products[i][j] + "</TD>")` displays the values at the `i`th row and `j`th column of array variable, `products`.

Figure 10.32 displays the product details in a table.



Figure 10.32: Output – Product Details in a Table

10.26 Array Methods

An array is a set of values grouped together and identified by a single name. In JavaScript, the `Array` object allows you to create arrays. It provides the `length` property that allows you to determine the number of elements in an array. Various methods of the `Array` object allow to access and manipulate the array elements.

Table 10.22 lists the most commonly used methods of the `Array` object.

Method	Description
<code>concat</code>	Combines one or more array variables
<code>join</code>	Joins all the array elements into a string
<code>pop</code>	Retrieves the last element of an array
<code>push</code>	Appends one or more elements to the end of an array
<code>sort</code>	Sorts the array elements in an alphabetical order

Table 10.22: Methods of Array Object

Code Snippet 40 demonstrates how to access and manipulate the array elements.

Code Snippet 40:

```
<script>
var flowers = new Array('Rose', 'Sunflower', 'Daisy');
document.write('Number of flowers: ' + flowers.length + '<br/>');
document.write('Flowers: ' + flowers.join(', ') + '<br/>');
document.write('Orchid and Lily are Added: ' + flowers.push("Orchid", "Lily") +
'<br/>');
document.write('Flowers (In Ascending Order) : ' + flowers.sort() + '<br/>');
document.write('Flowers Removed: ' + flowers.pop() + '<br/>');
</script>
```

Figure 10.33 displays the corresponding output of the script.

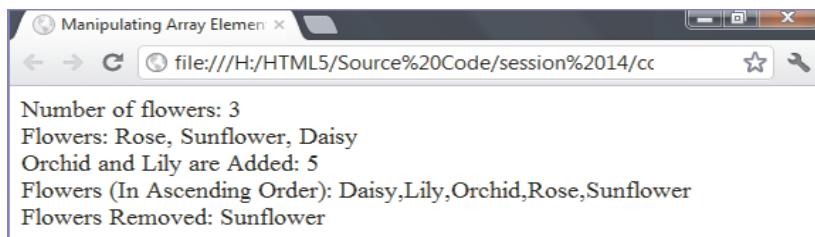


Figure 10.33: Output – Manipulating Array Elements

In the code, an array variable **flowers** is created, that stores the names of three flowers. The `length` property is used to display the number of flowers in the array variable. The `join()` method joins the flower names and separates them with a comma. The `push()` method adds orchid and lily at the end of the array and the total number of flowers in the array list is displayed as 5. The `sort()` method sorts the flowers in alphabetical order. The `pop()` method retrieves the last element that is Sunflower, from the array list.

10.27 for...in Loop

The `for...in` loop is an extension of the `for` loop. It enables to perform specific actions on the arrays of objects. The loop reads each element in the specified array and executes a block of code only once for each element in the array.

The syntax of the `for...in` loop is as follows:

Syntax:

```
for (variable_name in array_name) {  
    //statements;  
}
```

where,

 variable_name : Is the name of the variable.

 array_name : Is the array name.

Code Snippet 41 demonstrates how to display elements from an array using the `for...in` loop.

Code Snippet 41:

```
<script>  
    var books = new Array('Beginning CSS 3.0', 'Introduction to HTML5', 'HTML5 in  
    Mobile Development');  
    document.write('<H3>List of Books </H3>');  
    for(var i in books) {  
        document.write(books[i] + '<br/>');  
    }  
</script>
```

10.28 Check Your Progress

1. The _____ tag defines a script for an HTML page to make them interactive.

(A)	<script>	(C)	<title>
(B)	<head>	(D)	<html>

2. Which of the following is a piece of code that performs some operations on variables to fulfill a specific task?

(A)	Code	(C)	Function
(B)	Script	(D)	Variable

3. Which of the following is a process of specifying actions to be performed when an event occurs?

(A)	Event Handling	(C)	Scripting
(B)	Event Bubbling	(D)	Function

4. Match the relational operators with their corresponding descriptions.

Operator		Description	
a.	Logical AND	1.	Checks whether the operands are equal and are of the same type
b.	Logical OR	2.	Returns true if either of the operands are true
c.	Equal	3.	Returns true if both the expressions are true
d.	Strict Equal	4.	Checks whether the two operands are identical

(A)	a-3, b-2, c-4, d-1	(C)	a-4, b-3, c-2, d-1
(B)	a-2, b-3, c-4, d-1	(D)	a-1, b-2, c-3, d-4

5. Which of the following are the correct ways to create a regular expression?

(A)	Literal Syntax	(C)	RegExp Constructor
(B)	exec ()	(D)	test ()

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6. Which of the following operators return a decimal value when they are evaluated?

(A)	Arithmetic	(C)	Relational
(B)	Logical	(D)	Bitwise

7. Match the character symbols with their corresponding descriptions.

Symbol		Description	
a.	\D	1.	Matches alphabets and digits along with the underscore
b.	\d	2.	Matches a non-word character
c.	\w	3.	Matches a digit between 0 to 9
d.	\W	4.	Matches a non-digit

(A)	a-4, b-1, c-2, d-3	(C)	a-3, b-2, c-1, d-4
(B)	a-1, b-2, c-3, d-4	(D)	a-4, b-3, c-2, d-1

8. The _____ statement allows comparing a variable or expression with multiple values.

(A)	if	(C)	if-else
(B)	if-else if	(D)	switch-case

9. The _____ loop executes a block of code until the condition becomes false.

(A)	for	(C)	do-while
(B)	while	(D)	do-until

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10. Match the array methods with their corresponding descriptions.

Method		Description	
(A)	push	(1)	Joins all the array elements into a string
(B)	pop	(2)	Appends one or more elements to the end of an array
(C)	concat	(3)	Retrieves the last element of an array
(D)	join	(4)	Combines one or more array variables

(A)	a-4, b-1, c-2, d-3	(C)	a-2, b-3, c-4, d-1
(B)	a-1, b-2, c-3, d-4	(D)	a-3, b-2, c-4, d-1

11. Which of the following statement terminates the current execution, but does not terminate the execution of the loop entirely?

(A)	halt	(C)	break
(B)	continue	(D)	exit

12. Which of the following option is not a valid declaration of the for loop?

(A)	for (initialization; condition; increment/ decrement)	(C)	for (;condition; increment/decrement)
(B)	for (initialization; condition;)	(D)	for (condition; increment/decrement)

13. Identify the correct ways to create an array variable in the JavaScript.

(A)	Object	(C)	Array
(B)	new	(D)	String

10.28.1 Answers

1	D
2	D
3	D
4	A, D
5	D
6	A
7	C
8	A
9	B
10	C
11	B
12	D
13	B, C

Summary

- Scripting refers to a series of commands that are interpreted and executed sequentially and immediately on an occurrence of an event.
- JavaScript is a scripting language, which can be executed on the client-side and on the server-side. A client-side JavaScript is executed by the browser on the user's workstation.
- Event handling is a process of specifying actions to be performed when an event occurs.
- There are six category of JavaScript operators namely, Arithmetic, Relational, Logical, Assignment, Bitwise, and Special operators.
- In JavaScript, there are two ways to create regular expressions namely, literal syntax and RegExp() constructor.
- JavaScript supports four decision-making statements namely, if, if-else, if-else if, and switch-case statement.
- JavaScript supports three types of loops that include: while loop, for loop, and do-while loop.
- The break statement is used to exit the loop without evaluating the specified condition.
- The continue statement terminates the current execution of the loop and continues with the next repetition by returning the control to the beginning of the loop.
- JavaScript supports two types of arrays namely, Single-dimensional array and Multi-dimensional array.

Try It Yourself

1. Joaquina works for an online shopping Website named, Zambia Developers and is headquartered at Tokyo, Japan. She has created a Website on HTML5. The Website contains a registration form where the customer has to enter their details. Joaquina wants to add some validations on the registration form so that the details entered by the customers are in a proper format such as the name, mobile number, and so on. So she has decided to add JavaScript code for validation of the data present in Website. Help her to develop the application.

2. Write a JavaScript code to accept three numbers from the user and print the largest and the smallest number.

3. Write a JavaScript code that accepts name and password from the user and validates the data entered by the user. The validation criteria are as follows:
 - a. The value accepted for the name field should contain only characters with a maximum limit of 10 characters.
 - b. Similarly, value for the password field should be a combination of characters, digits, and underscore. Also, the password should start with one or more characters followed by the digits.

4. Write a JavaScript code that contains an expression for e-mail matching pattern. This pattern is checked with the e-mail address provided by the user and displays whether it is valid or invalid.

5. A school conducts a Mathematics competition for its students. The grade system for the competition is as follows:

Grade A: Marks greater than 75
Grade B: Marks in the range 60 to 75
Grade C: Marks in the range 45 to 60
Grade D: Marks less than 45

6. Write a JavaScript code to accept the marks from the user and display the grade achieved by the student.

7. Write a JavaScript code to create an array that store names of 10 students in it. Then, display the names of the students in an alphabetic order from the array. Also, use the for..in loop to display the name of the students from the array.

8. Write a JavaScript code to print the transpose of a matrix. Transpose of a matrix is where the rows are interchanged with columns and vice versa.



Session - 11

JavaScript - II

Welcome to the Session, **JavaScript - II**.

This session explains functions, which are independent reusable blocks of code, executed on the occurrence of an event. The session also explains the concept of objects used for storing and manipulating entities in JavaScript. Finally, it explains different types of built-in and browser objects supported by JavaScript. The session also covers advanced features of JavaScript such as getters and setters, promise objects, and also explores JSON.

In this Session, you will learn to:

- ➔ Explain functions
- ➔ Explain parameterized functions
- ➔ Explain return statement
- ➔ Describe objects
- ➔ Explain different browser objects
- ➔ Describe DOM and its objects
- ➔ Identify the use of Promise.any
- ➔ Explain Private class methods
- ➔ Explain JSON

11.1 Introduction

Consider a scenario where a Web page has been designed to greet the user with his/her name on the click of a button. A code can be used here to accomplish this task, but may result in the same output on repetitive execution. However, writing these statements each time for the same action is tedious, time consuming, and error prone.

To make the code more task-oriented and manageable, JavaScript allows to group statements before they are actually invoked. This can be achieved by using the concept of functions. A function is a reusable block of code that is executed on the occurrence of an event. The event can be a user action on the page or a call within the script.

11.2 Functions

A function is an independent reusable block of code that performs certain operations on variables and expressions to fulfill a task. A function might take parameters, which are variables or values on which it performs operations. After performing operations, a function might return the resultant value to display it in the browser. For example, a function named `Add()` might take two numbers on which the addition operation will be performed and will return the result of addition.

A JavaScript function is always created under the `script` element. JavaScript supports both user-defined and built-in functions.

Figure 11.1 shows the functions in an HTML page.



Figure 11.1: Functions in HTML Page

11.2.1 Declaring and Defining Functions

JavaScript allows declaring a function using the `function` keyword. The keyword is followed by the name of the function and parameters enclosed within the parenthesis. If the function does not take any parameters, then it must be specified with the empty parenthesis.

Once the function is declared, you must define the function by specifying the operations or instructions within the curly braces { and }. These curly braces indicate the start and end of the function block, which is collectively referred to as the body of the function.

There are certain conventions that must be followed for naming functions. They are as follows:

- Can consist of letter, digits, and underscore
- Can begin only with a letter or an underscore
- Cannot be a JavaScript keyword
- Cannot begin with a digit
- Cannot contain spaces

The syntax to create a function in JavaScript is as follows:

Syntax:

```
function function_name(list of parameters)
{
    // Body of the function
}
```

where,

function: Is a keyword used to declare a function.

function_name: Indicates the name of the function.

list of parameters: Is optional and specifies the parameters to be passed to the function separated by commas.

A function must be defined, before it can be invoked in the script. Also, there can be multiple functions defined within the `script` element.

Figure 11.2 shows the declaration and definition of a function.

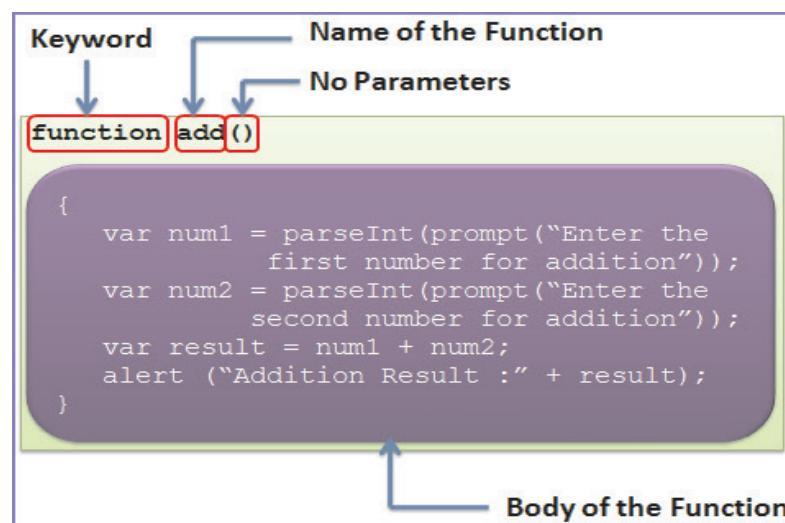


Figure 11.2: Declaration and Definition of a Function

11.2.2 Invoking Functions

A function requires to be invoked or called to execute it in the browser. To invoke a function, specify the

function name followed by parenthesis outside the function block.

A function can be defined and invoked even in an external JavaScript file. Also, a function can be called from another function in JavaScript. The function that invokes another function is called the **calling** function; whereas the function that is called is referred to as the **called** function.

Functions provide the benefit of code reusability by allowing the user to call a function multiple times.

Figure 11.3 shows invoking of function.

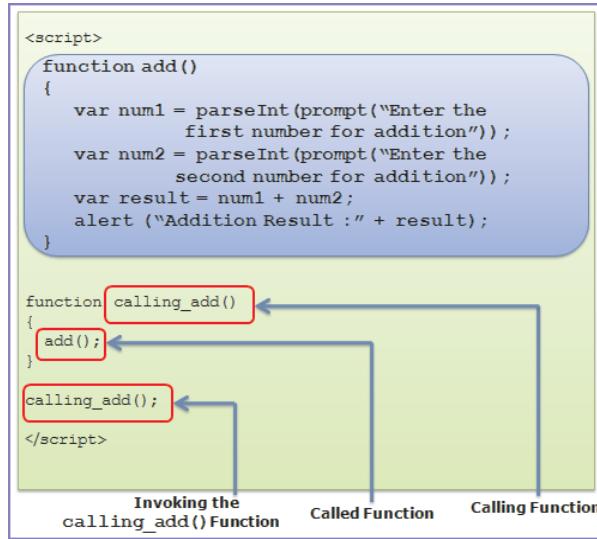


Figure 11.3: Invoking of Function

11.2.3 Parameterized Functions

Parameterized functions refer to JavaScript functions that take parameters. These parameters hold values on which the function requires to perform operations. Parameterized functions can be created to accept values for performing operations.

Figure 11.4 shows the parameterized functions.

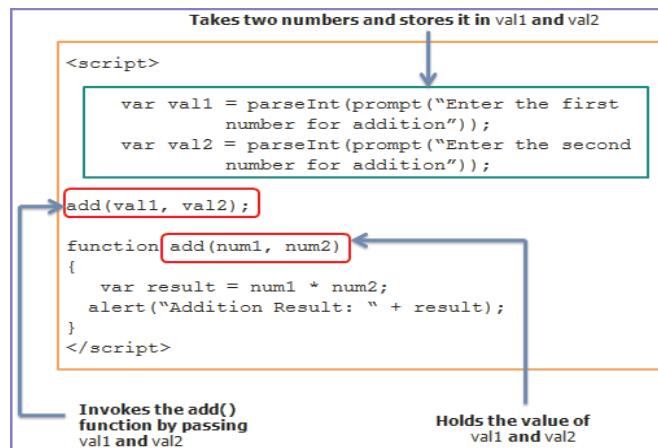


Figure 11.4: Parameterized Functions

As shown in Figure 11.4, the `num1` and `num2` parameters will hold the values of `val1` and `val2` arguments to perform the operations. The `num1` and `num2` parameters are only accessible within the function, whereas the `val1` and `val2` variables are accessible anywhere within the script element.

The parameters of a function are variables that are declared in the function declaration. Here, `num1` and `num2` are the parameters of the function. Similarly, arguments are the values passed to the function. Here, `val1` and `val2` are the arguments whose values are passed to the parameters, `num1` and `num2`, while invoking the function.

Alternatively, one can use same variable names for arguments and parameters while creating and invoking functions. In either of the case, the variables will occupy different memory space.

11.2.4 Ways of Passing Arguments

There are two ways of passing arguments to a function namely, pass by value and pass by reference. The description about these is as follows:

- **Passing by value** - Refers to passing variables as arguments to a function. In the pass by value method, the called function do not change the values of the parameters passed to it from the calling function.

This is because each parameter occupies different memory locations.

Figure 11.5 shows the pass by value method.

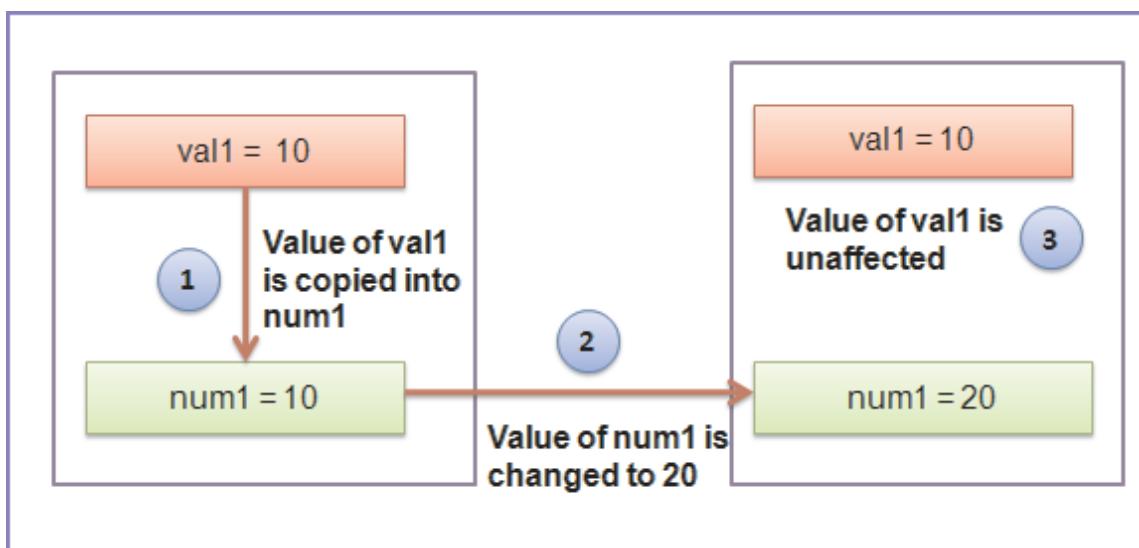


Figure 11.5: Pass By Value Method

- **Passing by reference** - Refers to passing objects as arguments to a function. In the pass by reference method, the called function modifies the value of parameters passed to it from the calling function. This change is reflected when the control passes back to the calling function.

Figure 11.6 shows the pass by reference method.

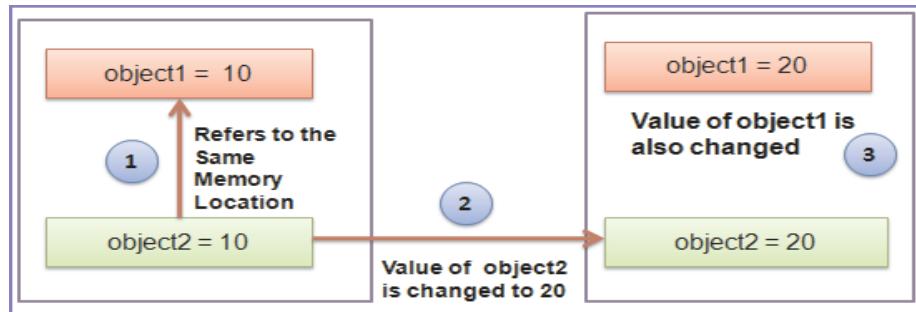


Figure 11.6: Pass By Reference Method

Code Snippet 1 demonstrates the code to pass Array object as a parameter to a function.

Code Snippet 1:

```
<script>
var names = new Array('James', 'Kevin', 'Brad');
function change_names(names) {
    names[0] = 'Stuart';
}
function display_names() {
    document.writeln('<h3>List of Student Names:</h3>');
    document.write('<ul>');
    for(var i=0; i<names.length; i++) {
        document.write('<li>' + names[i] + '</li>');
    }
    document.write('</ul>');
    change_names(names);
    document.write('<h3>List of Changed Students Names:</h3>');
    document.write('<ul>');
    for(var i=0; i<names.length; i++) {
        document.write('<li>' + names[i] + '</li>');
    }
    document.write('</ul>');
}
display_names();
</script>
```

In the code, the function `change_names(names)` takes the `names` array as parameter. It changes the value at the 0th position in the array. The function is further invoked in the `display_names()` function. The `display_names()` function displays the values from the array before and after the value is changed at the 0th position in the array.

Figure 11.7 shows the passing of an array to a function. It is assumed that the script is enclosed in an HTML file and then, executed on the browser.

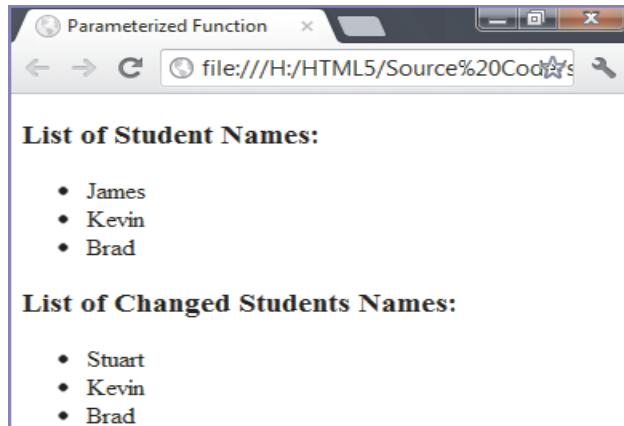


Figure 11.7: Passing an Array Object to Function

11.2.5 *return Statement*

A function operates on its parameters that might lead to some output values. This output must be displayed to the user or it must be sent back to the calling function. JavaScript allows sending the result back to the calling function by using the `return` statement.

The `return` statement begins with `return` keyword followed by the variable or value, which must be returned to the calling function. The `return` statement can also be used to halt the execution of the function and to return the control to the calling function. This is required when a particular condition is false or when there are chances of unexpected results during the code execution.

Code Snippet 2 demonstrates the script that calculates the factorial of a number using a function and display the output to the user.

Code Snippet 2:

```
<script>
function factorial (num) {
    if (num==0)
        return 0;
    else if (num==1)
        return 1;
    else {
        var result = num;
        while (num>1)
        {
            result = result * (num-1);
            num--;
        }
        return result;
    }
}
```

```
        }
    }

var num=prompt ('Enter number:', '');
var result=factorial (num);
alert ('Factorial of ' +num+ ' is ' +result+'.');
</script>
```

The code defines a function named **factorial()** which takes the **num** variable as the parameter. The execution of the script starts from the **prompt()** function, which takes the number from the user and stores it in the **num** variable. Next, the **factorial()** function is invoked by passing the **num** argument. If the user enters the value as 0 or 1, the function returns the value as 0 or 1 respectively. For any other number, the function calculates the factorial and returns the output value by using the return statement. The output is stored in the **result** variable, which is displayed to the user.

Figure 11.8 displays the factorial of a number.

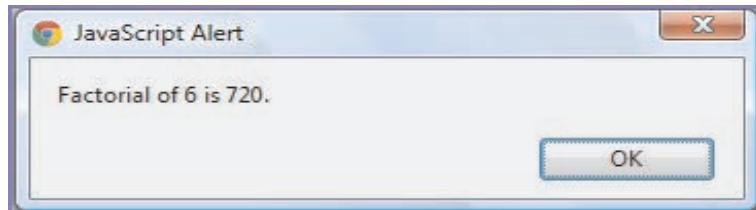


Figure 11.8: Factorial of Number

Similarly, the return statement can be used to return a collection of values stored in arrays. Figure 11.9 shows a **display_list()** function which declares and initializes an array named, **languages** to store the languages. The function returns an array whose values are then displayed to the user.

```
<script>

    function display_list()
    {
        var languages = new
            Array('English', 'Dutch',
                  'German');
        return languages;
    }

    document.write("<B> languages: </B>" +
                  display_list());
</script>
```

Figure 11.9: Returning Arrays

11.3 Objects

Objects are entities with properties and methods and resemble to real life objects. Properties specify the characteristics or attributes of an object, while methods identify the behavior of an object. For example, consider a real life object namely, **Car**.

The attributes of the `Car` object can include color, car number, and model. The methods of the car could be `run()` that specifies the running behavior of the car. Similarly, in JavaScript, objects have their own properties and methods.

Figure 11.10 shows objects with their properties and methods.

Object: Car	Properties	Make - ford Color - green Wheels – four
	Methods	<code>run()</code> <code>stop()</code>
<hr/>		
Object: Bird	Properties	Type - pigeon Color - gray Wings - two
	Methods	<code>eat()</code> <code>fly()</code>

Figure 11.10: Objects with Properties and Methods

JavaScript provides built-in objects and allows creating user-defined objects. The description of the object is as follows:

- **Built-in Objects** - Are pre-defined objects which are already defined. Their properties and methods must be called to fulfill a task. An example of a pre-defined object is the `Array` object.
- **Custom Objects** - Are user-defined objects, which the developer explicitly creates in the script and defines their properties and methods. For example, to store doctor details, such as name, age, hospital name, and so on an object named `doctor` can be created.

11.3.1 Creating Custom Objects

The `Object` object is the parent object from which all JavaScript objects are derived. Custom objects can be derived from this object by using the `new` keyword.

There are two main methods to create a custom object. In the first method, an object can be created by using the built-in `Object` object, which is also known as the `direct` method. In the second method, an object can be created by defining a template and initializing it with the `new` keyword.

The syntax to create the object using these methods are as follows:

→ **Direct Method**

The syntax to create a custom object using the `Object` object is as follows:

Syntax:

```
var object_name = new Object();
```

where,

`object_name`: Is the name of the object.

new: Is the keyword that allocates memory to the custom object. This is known as instantiation of an object.

Object: Is the built-in JavaScript object that allows creating custom objects.

→ **Template Method**

An object's template refers to a structure that specifies the custom properties and methods of an object. There are two steps in creating an object by using this method. First, the object type is declared using a constructor function. Second, you specify the object of the declared object type by using the **new** keyword.

JavaScript allows creating a reusable template without having to redefine properties and methods repeatedly to fulfill a particular object's requirements. This template is known as the constructor function. A constructor function is a reusable block that specifies the type of object, its properties, and methods. It might or might not take any parameters. After creating the constructor function, you specify an object of the declared object type using the **new** keyword. The **new** keyword allocates memory for the object and invokes a constructor function.

The syntax to create a constructor function is as follows:

Syntax:

```
function object_type(list of parameters)
{
// Body specifying properties and methods
}
```

where,

object_type: Indicates the object type.

list of parameters: Is optional and specifies the parameters to be passed to a function separated by commas.

The syntax to create the object using the **new** keyword is as follows:

Syntax:

```
object_name = new object_type(optional list of arguments);
```

where,

object_name: Is the name of the object.

Code Snippet 3 shows the creation of objects using direct method and template method.

Code Snippet 3:

```
<script>
//create an object using direct method
var doctor_details=new Object();
//create an object using new keyword
studOne=new student_info ('James', '23', 'New Jersey');
</script>
```

In the code, **doctor_details** object is created using the **Object** object.

After creating the object, properties and methods can be specified. Similarly, **student_info** object is created using new keyword. The values 'James', '23', and 'New Jersey' are the properties of the **student_info** which are initialized by constructor function during creation.

11.3.2 Creating Properties for Custom Objects

Properties specify the characteristics of an object. They can be specified for objects created through Object or template method. To create and access a property of an object created using Object object, specify the object name followed by a period and the property name.

Code Snippet 4 demonstrates the script that creates the **student_details** object and adds properties namely, **first_name**, **last_name**, and **age** along with their values.

Code Snippet 4:

```
<script>
var student_details=new Object();
student_details.first_name= 'John';
student_details.last_name= 'Fernando';
student_details.age= '15';
alert ('Student\'s name: '+student_details.first_name+ ' ' +
      student_details.last_name);
</script>
```

The code specifies three properties of the **student_details** object namely, **first_name**, **last_name**, and **age** along with their values. The values of these properties are displayed in the browser using the **write()** method.

Figure 11.11 shows the output of the **student_details** object.

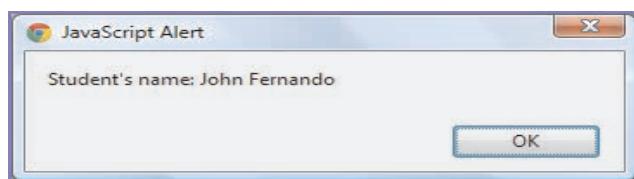


Figure 11.11: Output – student_details Object

Similarly, if the template method is implemented to create a custom object, then a constructor function is used to declare properties for an object.

Code Snippet 5 creates the `employee_info` object and adds properties in the constructor function.

Code Snippet 5:

```
<script>
    // To define the object type
    function employee_info(name, age, experience)
    {
        this.name = name;
        this.age = age;
        this.experience = experience;
    }
    // Creates an object using new keyword
    empMary = new employee_info('Mary', '34', '5 years');
    alert ("Name: " + empMary.name + '\n' + "Age: " + empMary.age + '\n'
          + "Experience: " + empMary.experience);
</script>
```

The code specifies three properties namely, `name`, `age`, and `experience` along with their values in the constructor function. The object named `empMary` is created, which passes the values as the arguments. This invokes the constructor function and initializes the properties to their values. The `this` keyword is a reference to the current object whose properties are being initialized. It is used in the constructor to resolve conflict between the property and the parameter, both of which have the same name. The `this` keyword marks the distinction between the two, while assigning the value to the properties of an object.

Figure 11.12 displays the output of the `employee_info` object.

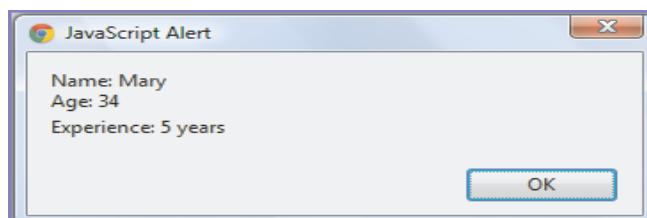


Figure 11.12: Output of the `employee_info` Object

11.3.3 Creating Methods for Custom Objects

Methods are similar to JavaScript functions, but there is a slight difference between them. A method is always associated with an object and is executed by referring to that object. On the other hand, a function is not associated with any object and is executed independently. Similar to functions, the custom methods can also take parameters.

One or more methods can be specified after creating an object using the `Object` object or while creating the template. To invoke a method, they must be specified with the object name followed by a period, method name, and parenthesis with parameters, if any.

Code Snippet 6 demonstrates the code that defines a custom method to calculate the area of a square.

Code Snippet 6:

```
<script>
    var square = new Object();
    square.length = parseInt("5");
    square.cal_area = function()
    {
        var area = (parseInt(square.length) * parseInt("4"));
        return area;
    }
    alert ("Area: "+square.cal_area());
</script>
```

The code defines a custom object named **square** whose **length** property is set to a numeric value 5. It also defines a custom function named **cal_area()**, which calculates the area of the square and returns the result.

Figure 11.13 displays the output of the area of a square.

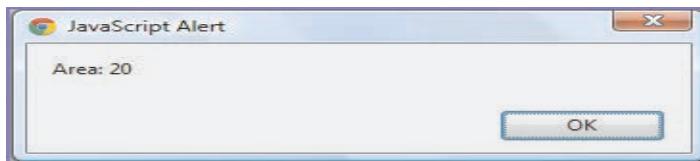


Figure 11.13: Output of the Area of Square

Similarly, methods can be specified while using template method for creating a custom object. The implementation of custom methods is same for creating and invoking methods as specified for the direct method. However, in the template method, an ordinary function is created to implement the functionality. Then, this function is assigned to the custom method. Such functions are known as **method functions**. To invoke the function, you specify the object name followed by a period and the method name.

Code Snippet 7 demonstrates the script that creates a custom method and associates it with the method function.

Code Snippet 7:

```
<script>
//Define a Method Function
function cal_diameter()
{
    var diameter = this.radius*2;
    return diameter;
}
//Define a Constructor Function
```

```
function circle(radius)
{
    this.radius = radius;
    this.get_diameter = cal_diameter;
}
//Create the object
circleObj = new circle('10');
alert ('Diameter: '+circleObj.get_diameter());
</script>
```

The code creates an object, `circleObj` and invokes custom method `get_diameter()`, which in turn invokes the function, `cal_diameter()`.

11.4 Built-in Objects

The object model of JavaScript language forms the foundation of the language. These objects help to provide custom functionalities in the script.

JavaScript treats the primitive data types as objects and provide equivalent object for each of them. For example, if a variable contains a string of characters, then it is treated as `String` object by JavaScript. Similarly, if a variable contains the value `true` or `false`, it is treated as `Boolean` object.

JavaScript objects are categorized as built-in objects, browser objects, and HTML objects.

The built-in objects are static objects which can be used to extend the functionality in the script. Some of these objects are: `String`, `Math`, and `Date`. The browser objects, such as `window`, `history`, and `navigator` are used to work with the browser window, whereas the HTML objects, such as `form`, `anchor`, and so on are used to access elements on a Web page.

11.4.1 String Object

Strings in JavaScript are a set of characters that are surrounded by single or double quotes. These characters can include alphabets, numbers, spaces, and symbols: %, @, &, and so on. The built-in `String` object allows you to perform different text operations on them. Some of the examples of these operations include: searching for a specific character occurrence, retrieving a substring, merging two set of characters, and so on.

The `String` object is instantiated with the `new` keyword, which invokes the predefined constructor function of the `String` object.

The syntax to initialize the `String` object is as follows:

Syntax:

```
var object_name = new String("Set of characters");
```

where,

`object_name`: Is the instance of the `String` object

The `String` object provides different properties and methods to manipulate strings.

Table 11.1 lists the properties of the `String` object.

Property	Description
<code>length</code>	Retrieves the number of characters in a string.
<code>prototype</code>	Adds user-defined properties and methods to the <code>String</code> instance.

Table 11.1: Properties of the String Object

Table 11.2 lists the methods of the `String` object.

Method	Description
<code>charAt()</code>	Retrieves a character from a particular position within a string.
<code>concat()</code>	Merges characters from one string with the characters from another string and retrieves a single new string.
<code>indexOf()</code>	Retrieves the position at which the specified string value first occurred in the string.
<code>lastIndexOf()</code>	Retrieves the position at which the specified string value last occurred in the string.
<code>replace()</code>	Matches a regular expression with the string and replaces it with a new string.
<code>search()</code>	Searches for a match where the string is in the same format as specified by a regular expression.
<code>split()</code>	Divides the string into substrings and defines an array of these substrings.
<code>substring()</code>	Retrieves a part of a string between the specified positions of a string.
<code>toLowerCase()</code>	Specifies the lowercase display of the string.
<code>toUpperCase()</code>	Specifies the uppercase display of the string.

Table 11.2: Methods of the String Object

Code Snippet 8 demonstrates the script that creates a `String` object and test various methods on it.

Code Snippet 8:

```
<script>
var full_name=new String('David James Taylor');
document.write('Number of Characters are: '+full_name.length+'<br/>');
document.write('Character at Position 6 is: '+full_name.charAt(6)+'<br/>');
document.write('Student\'s Name and their Father\'s name are: '+full_name.
split(' ',2)+'<br/>');
document.write('Student\'s FullName is: '+full_name.toUpperCase());
</script>
```

Figure 11.14 displays the output of string manipulation.

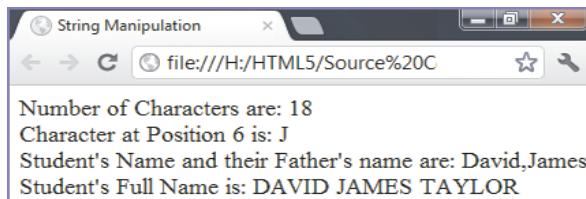


Figure 11.14: Output – String Manipulation

11.4.2 Math Object

The `Math` object allows the user to perform mathematical operations on numeric values. The `Math` object is a pre-defined object that provides static properties and methods to perform mathematical operations. The properties and methods are declared as static, thus they can be invoked directly with the object name. In other words, no object instantiation is required for the `Math` object.

The syntax to access the properties of the `Math` object is as follows:

Syntax:

```
var variable_name = Math.PropertyName;
```

where,

`PropertyName`: Is the name of the property

Similarly, the syntax to invoke the methods of the `Math` object is as follows:

Syntax:

```
var variable_name = Math.MethodName(optional list of parameters);
```

Code Snippet 9 demonstrates the script that calculates area of a circle using the `Math` object.

Code Snippet 9:

```
<script>
var full_name=new String ('David James Taylor');
document.write('Number of Characters are: '+full_name.length+'<br/>');
var area=Math.floor(tempArea);
    return area;
}
alert('Area of circle is: '+area_circle(5));
</script>
```

In the code, `Math.PI` is a property that stores the value 3.142 into the variable, `pi`. The `Math.pow(radius, 2)` method calculates the radius raised to the power 2. Similarly, `Math.floor(tempArea)` method rounds the resultant value to a number less than or equal to the resultant value.

Figure 11.15 shows the area of circle with the radius5.

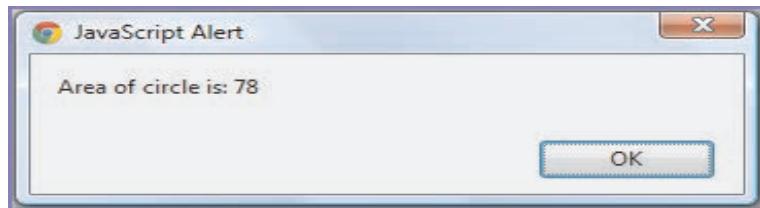


Figure 11.15: Area of Circle with the radius5

11.4.3 Date Object

The `Date` object allows you to define and manipulate the date and time values programmatically. It supports both the Universal Time Coordinated (UTC) and Greenwich Mean Time (GMT) conventions. GMT is the standard time zone that includes Greenwich and divides the globe into 24 zones, each with a difference of an hour in time. UTC splits time into days, hours, minutes, and seconds and approximates GMT.

The `Date` object calculates dates in milliseconds from 01 January, 1970. The date and time can be specified by creating an instance of the `Date` object.

Various syntax to instantiate the `Date` object are as follows:

Syntax:

- a. To instantiate the `Date` object with the current date and time as that of the local machine.

```
var object_name = new Date();
```

where,

`object_name`: Is the instance of the `Date` object.

- b. To instantiate the `Date` object by providing passed milliseconds, since 01 January, 1970 as the parameter.

```
var object_name = new Date(milliseconds);
```

- c. To instantiate the `Date` object by passing date values and optional time values as the parameters.

```
var object_name = new Date(year, month, day, hour, minutes, seconds, milliseconds);
```

Here, the `Date` object refers to the month numbers from 0 to 11 and treats the first month as 00. Therefore, one must specify 02 as the month value for the March month. If the optional arguments are not supplied, they are set to 0.

- d. To instantiate the `Date` object by passing date values and optional time values in quotes as the parameter.

```
var object_name = new Date("dateString");
```

Table 11.3 lists the methods of the Date object.

Method	Description
getDate()	Retrieves a numeric value between 1 and 31 which indicates the day of the month.
getDay()	Retrieves a numeric value between 0 and 6 which indicates the day of the week. For example, Sunday is 0, Monday is 1, and so on.
getTime()	Retrieves a numeric value which indicates the time passed in milliseconds since midnight 01/01/1970.
getFullYear()	Retrieves a four digit numeric value which indicates the year in the given date.

Table 11.3: Methods of the Date Object

Code Snippet 10 demonstrates the script that displays the current date in the mm/dd/yyyy format.

Code Snippet 10:

```
<script>
function display_date()
{
    var today=new Date();
    var date=today.getDate();
    var month=today.getMonth();
    month++;
    var year=today.getFullYear();
    alert ('Today\'s date is: '+month+'/'+date+'/'+year);
}
display_date();
</script>
```

Figure 11.16 displays the current date.

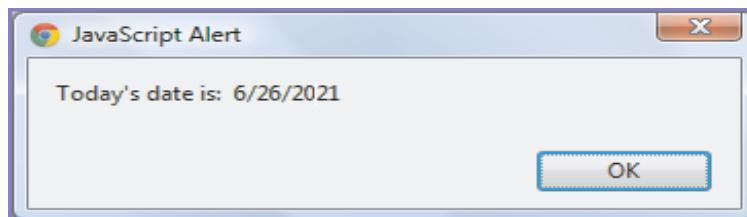


Figure 11.16: Current Date

11.4.4 with Statement

The with statement allows to remove the object reference for each JavaScript statement. This is done by referring to the common object only once for a set of statements.

The with statement starts with the with keyword followed by the open and close brackets, which holds the statements that refer to a common object. This increases the readability of the code and also reduces time required in writing each object reference in each related statement.

The syntax to declare the `with` statement is as follows:

Syntax:

```
with(object_name)
{
    //Statements
}
```

where,

`object_name`: Is the name of a common object for the set of statements.

Figure 11.17 displays `with` statement.

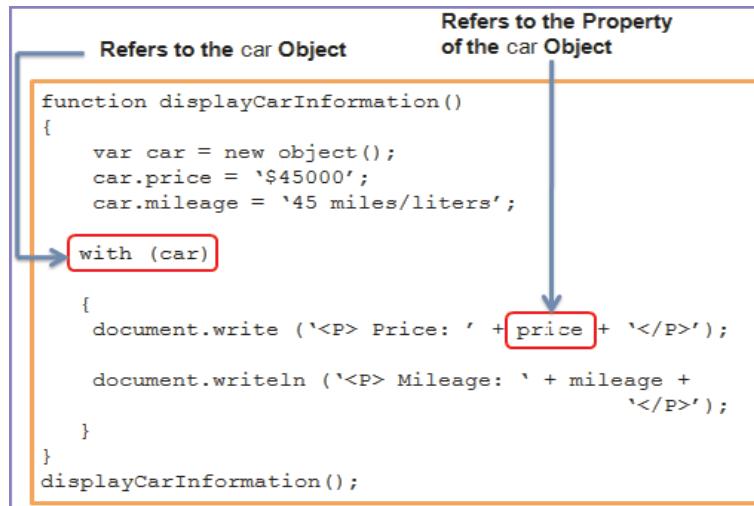


Figure 11.17: `with` Statement

11.5 Browser Objects

Apart from built-in objects, JavaScript also provides objects to access and manipulate various aspects of a Web browser. These objects are called as browser objects. They exist on all pages displayed in the browser and correspond to elements on a page.

For example, browser objects allow accessing various characteristics of the browser, such as browser window itself, browser history, changing current URL, and moving backward and forward in the browser. Figure 11.18 shows the hierarchy of browser objects.

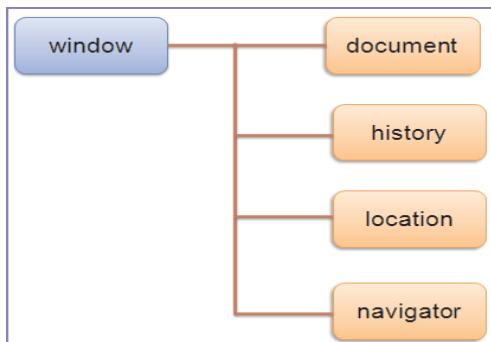


Figure 11.18: Hierarchy of the Browser Objects

The brief description for some of these objects is as follows:

→ **window Object**

The window object is the top level object in JavaScript hierarchy. This means that all the objects in the hierarchy are descendants of the window object. The window object represents a browser window. It contains browser information, such as the look and feel of the browser, its version, and so on.

The window object provides properties that allows setting a default text for the status bar, name of the browser window, retrieve history, and so on.

Table 11.4 lists some of the commonly used properties of the window object.

Property	Description
defaultStatus	Specifies or retrieves the default text to be displayed in the status bar of the browser window.
document	Represents an HTML document that contains different elements.
history	Contains history of the visited Uniform Resource Locators (URLs).
location	Contains the content of the specified URL.
innerWidth	Specifies the inner width of the window's content area.
innerHeight	Specifies the inner height of the window's content area.

Table 11.4: Properties of the window Object

The window object provides methods that allows displaying error messages, confirmation boxes, and so on.

Table 11.5 lists the methods of the window object.

Method	Description
alert()	Displays an alert box that states the message and an OK button.
confirm()	Prompts a dialog box that displays a message with the OK and Cancel buttons.
createPopup()	Creates a pop-up window.
focus()	Focuses the current window.
open()	Opens the specified file in a new browser window.
prompt()	Prompts a dialog box that accepts input from the user.

Table 11.5: Methods of the window Object

Code Snippet 11 demonstrates the methods of the window object.

Code Snippet 11:

```
<!DOCTYPE html>
<head>
<title>windowObject </title>
<script>
function new_window() {
    if(confirm('Do you want to open a new page?'))
    {
        window.open('https://www.wikipedia.org/','_parent');
    }
    else
    {
        window.alert('In the Current Window');
    }
}
</script>
</head>
<body>
<input type="button" value="Click to move to the next page" onClick =
"new_window();"/>
</body>
</html>
```

The code invokes the function `new_window()` on a button click. This function asks the user regarding opening of a new page. If user clicks OK, then `https://www.wikipedia.org/` page is opened in the current window. Otherwise, displays a message to the user.

→ **history Object**

The `history` object is a part of the `window` object. It contains a set of URLs visited by a user in a browser window. The `history` object is an array that allows referring to a particular URL by specifying its index number in the array. The `length` property allows you to determine the number of URLs in the history list.

Table 11.6 lists the methods of the `history` object.

Method	Description
<code>back()</code>	Retrieves and displays the previous URL from the history list.
<code>forward()</code>	Retrieves and displays the next URL from the history list.
<code>go()</code>	Displays the specified URL. It accepts a parameter, which can either be a string or a number to go to specific page.

Table 11.6: Methods of the history Object

Note - Although navigator Object also exists and can be used to retrieve information about a browser, the information is not accurate and cannot be relied on. For example, the appName property of navigator object returns 'Netscape' for all browsers regardless of their actual name.

→ **location Object**

The location object allows to access complete information of the URL loaded in the browser window. It is a part of the Window object. A single URL is composed of different portions, such as the host name, port number, and so on which can be accessed through the location object.

Table 11.7 lists properties and methods of the location object.

Property/Method	Description
host	Retrieves host name and port number of the URL.
href	Specifies or retrieves the entire URL.
pathname	Specifies or retrieves the path name of the URL.
protocol	Specifies or retrieves the protocol of the URL.
assign()	Loads a new document with the specified URL.
reload()	Reloads current document by again sending request to the server.
replace()	Overwrites URL history for current document with the new document.

Table 11.7: Properties and Methods of the location Object

Code Snippet 12 demonstrates the use of location object to retrieve different portions of the specified URL.

Code Snippet 12:

```
<!DOCTYPE html>
<head>
<title> locationObject </title>
<script>
function display_URLInfo() {
    alert('Protocol name: ' +location.protocol+ '\n' + 'Path name: '
          +location.pathname);
}
</script>
</head>
<body>
<input type="button" value="View URL Information" onclick=
    "display_URLInfo()" />
</body>
</html>
```

Figure 11.19 shows the details of the specified URL.

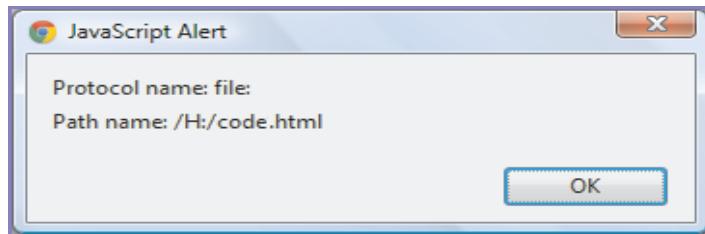


Figure 11.19: Details of Specified URL

11.6 Document Object Model (DOM)

A Web page contains various elements, such as buttons, text boxes, check boxes, and so on. These elements exist in a hierarchy and overall represent an HTML document.

JavaScript allows the user to access HTML elements and also change the existing structure of an HTML document. This can be done by using DOM specification. The DOM is an API that defines the object structure for accessing and manipulating HTML elements. It is used with JavaScript to add, modify, or delete elements and contents on a Web page.

DOM specifications are laid by W3C and are implemented by all the browsers to overcome incompatibility issues. W3C DOM specifications are divided into levels. The level 1 specification of DOM was first defined in 1998. The current DOM specification is level 3.

The DOM reads all the elements contained in an HTML page. It treats the HTML elements as nodes. According to DOM specification, the entire HTML document represents a document node. This document node consists of element nodes, attribute nodes, and text nodes. Thus, the document node is the highest level node and text nodes are the lowest ones. Each node in the node hierarchy has a parent node, which consists of multiple child nodes. For example, `<head>` and `<body>` are the child nodes of `<html>`. All these nodes together form up a node tree and are related to each other.

Code Snippet 13 shows a simple HTML document.

Code Snippet 13:

```
<!DOCTYPE html>
<html>
<head>
<title>Welcome</title>
</head>
<body>
    <h1> Introduction </h1>
    <a href="#">Click Here</a>
</body>
</html>
```

Figure 11.20 shows the DOM structure of HTML document.

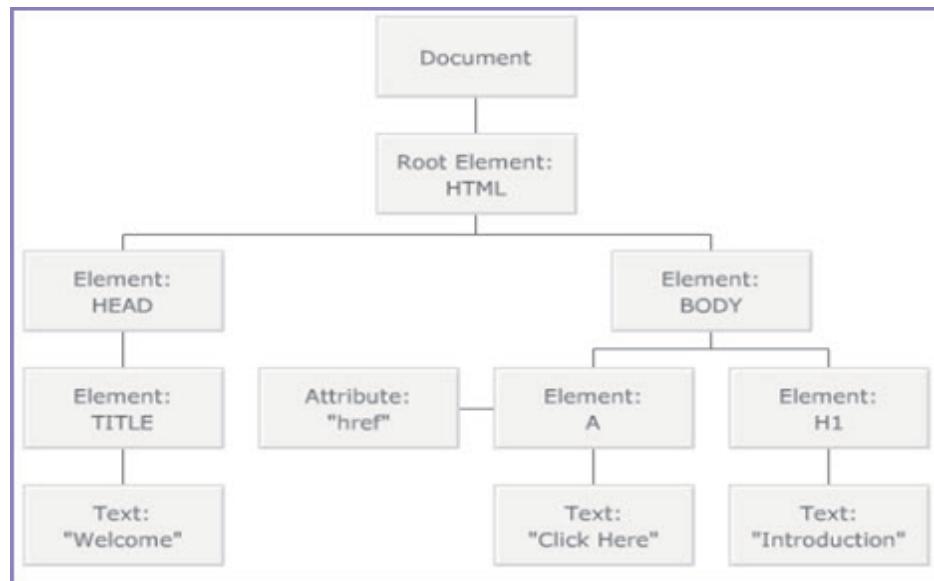


Figure 11.20: DOM Structure

All the nodes present in the node hierarchy contain certain properties. These properties provide information about the node. Different node properties are as follows:

- **nodeName** - Represents name of the node. It contains the tag name of the HTML element in upper case.
- **nodeValue** - Represents text contained within the node. This property is only available for attribute nodes and not for document and element nodes.
- **nodeType** - Represents the type of the node. For example, the document node, element node, and so on.

The HTML DOM provides standard objects for HTML documents. Some of these objects are as follows:

- Document object
- Form object
- Link object
- Table object

The brief description for some of these objects is as follows:

- **Document Object**

The HTML DOM provides a document object which is used within JavaScript to access all HTML elements presented on the page. The document object is one of the basic JavaScript object. It represents the entire HTML document. It provides access to other elements, such as links, anchors, and so on. Each HTML page has only one document object. This object is created when the BODY

element is loaded on the Web page. The document object is also the part of the window object and is accessed as `window.document`. The document object provides properties that allow the user to specify or retrieve the information about the elements and its content.

Table 11.8 lists the properties of the document object.

Property	Description
<code>body</code>	Provides access to the BODY element.
<code>head</code>	Returns the <code><head></code> element of the document.
<code>title</code>	Specifies or retrieves the title of the document.
<code>anchors</code>	Retrieves the collection containing all the anchors contained in a document.
<code>forms</code>	Retrieves the collection containing all the forms contained in a document.
<code>images</code>	Retrieves the collection containing all the images contained in a document.
<code>links</code>	Retrieves the collection containing all the links contained in a document.

Table 11.8: Properties of the document Object

The document object provides methods that allow retrieving the HTML elements using the id, name, and tag name.

Table 11.9 lists the methods of the document object.

Property	Description
<code>close()</code>	Closes a data stream and displays the data collected using <code>open()</code> method.
<code>getElementById()</code>	Retrieves a collection of HTML elements by using specified ID.
<code>getElementsByName()</code>	Retrieves a collection of HTML elements by using the specified name.
<code>getElementsByTagName()</code>	Retrieves a collection of HTML elements with specified tag name.
<code>open()</code>	Opens a stream to accept output from <code>write()</code> or <code>writeln()</code> methods.
<code>write()</code>	Writes text or HTML expression to a document.

Table 11.9: Methods of the document Object

Code Snippet 14 demonstrates the use of the `document` object to change the image on the click of a button.

Code Snippet 14:

```
<!DOCTYPE html>
<head>
<title> Document Object </title>
<script>
function change_image() {
```

```
var imgText=document.getElementById('myImg').alt;
if(imgText=="ford")    {
    document.getElementById('myImg').src="ferrari.jpg";
    document.getElementById('myImg').alt="ferrari";
    document.getElementById('mytext').value="Ferrari Car";
}
else  {
    document.getElementById('myImg').src="ford.jpg";
    document.getElementById('myImg').alt="ford";
    document.getElementById('mytext').value="Ford Car";
}
}
</script>
</head>
<body>
<br/>
Model: <input type="text" id="mytext" value="Ford Car"
readonly="readonly"/><br/><br/>
<input type="button" value="Change Image" onclick="change_image () "/>
</body>
</html>
```

In the code, image and text elements on the page are accessed using `document.getElementById()` method. The method retrieves elements based on specified ids and sets new values for their properties. This is all done at runtime and not through markup. The use of `document.getElementById()` enables to access the elements within JavaScript function and change them dynamically. Figures 11.21 and 11.22 show the initial image and changed image respectively on clicking Change Image button.

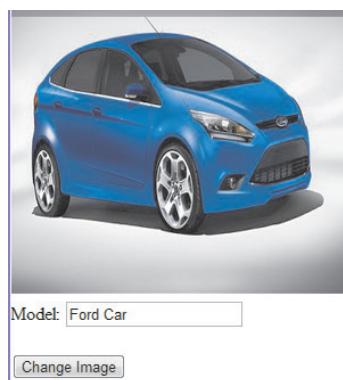


Figure 11.21: Initial Image

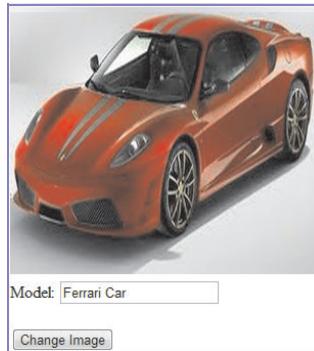


Figure 11.22: Changed Image

→ **Form Object**

Form accepts input from the user and sends data for validation. JavaScript allows you to process and validate the form data. A single HTML document can contain multiple forms. The DOM specification provides a `form` object that represents an HTML form. A `form` object is created for each `<form>` tag in an HTML document. Code Snippet 15 demonstrates the use of the `form` object that counts number of controls in a form.

Code Snippet 15:

```
<!DOCTYPE html>
<head>
<title>Form Object </title>
<script>
function display_length() {
    var count =document.getElementById("form1").length;
    alert('Number of controls on the form: ' + count);
}
</script>
</head>
<body>
<form id="form1" action="welcome.php">
First name: <input type="text" name="firstname" value="John" /><br />
Last name: <input type="text" name="lastname" value="Smith" /><br />
Age : <input type="text" name="age" value="40" /><br />
<input type="button" value="Controls"onClick="display_length()" />
</form>
</body>
</html>
```

In the code, a Web page contains a form with input elements, such as text and a button. The form is accessed in JavaScript using the `id` attribute which is set to `form1`. Then, the `length` property

of the form object is used to retrieve the number of elements in a form.

Thus, the statement `form1.length` returns the value 4, that is stored in the variable `count`. Finally, the value of variable `count` is displayed in the alert window.

Figure 11.23 shows the number of controls in the form.

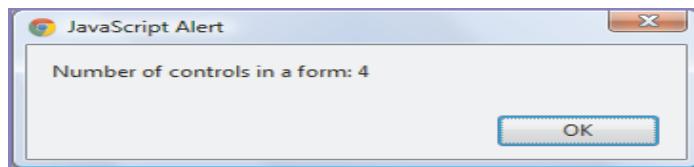


Figure 11.23: Controls in a Form

11.7 DOM and JavaScript

Although JavaScript and DOM are separate entities, they are closely related. DOM is an essential component for JavaScript because it helps in identifying HTML documents, XML documents, Web pages, and associated components. These components include header of the document, tables, table headers, table content, which are part of the DOM. Figure 11.24 depicts a visual representation of DOM.

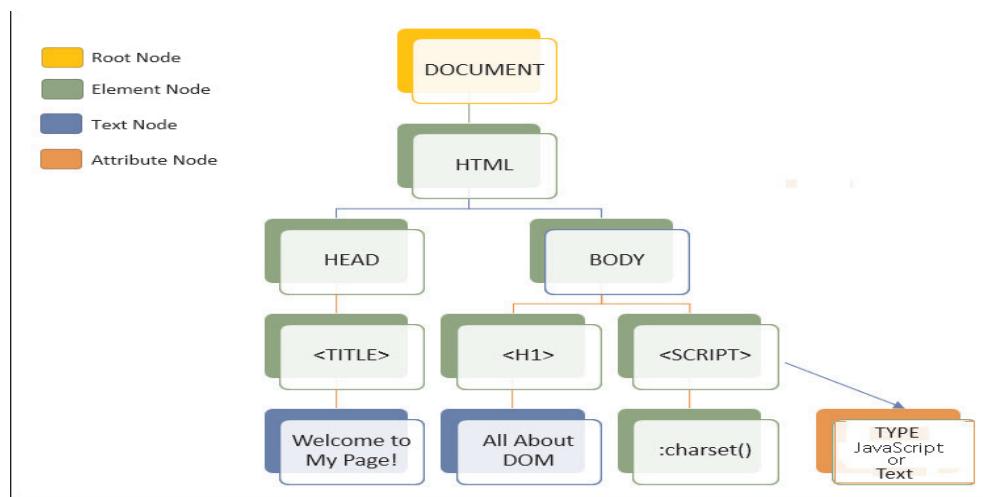


Figure 11.24: DOM and its Components

11.7.1 New Features in JavaScript DOM

Table 11.10 lists some of new declaration keywords introduced in JavaScript.

Declaration	Description
<code>const</code>	Means identifier cannot be reassigned. One should use <code>const</code> to declare objects, arrays, or functions.
<code>let</code>	Helps in reassigning variables.
<code>var</code>	Mostly used for Block Scope. Any variable declared within {} is out of scope.

Table 11.10: New Declaration Keywords

11.7.2 Arrow Functions

Arrow functions are a mechanism used to create functions in a simple manner. They must be defined before they are used.

Code Snippet 16 shows how a function used to be created in earlier versions of JavaScript.

Code Snippet 16:

```
function myFunction(argA , argB , argC) {  
    /*  
     * Write the steps of code here  
     * */  
}
```

Using the arrow function, the code can be written as shown in Code Snippet 17.

Code Snippet 17:

```
const myFunction = (argA , argB , argC) => {  
};
```

Arrow functions are especially useful when working with functions that require another function as an argument. For example, the code in Code Snippet 18 can be replaced with that in Code Snippet 19.

Code Snippet 18:

```
document.addEventListener("DOMContentLoaded" , function () {  
    console.log("loaded");  
})
```

Code Snippet 19:

```
document.addEventListener("DOMContentLoaded" , ()=>{  
    console.log("loaded");  
})
```

11.7.3 For Of Loop

The `for ... of` loop statement creates a loop that repeats over iterable objects, such as arrays, maps, strings, and more. Code Snippet 20 shows the syntax of this statement.

Code Snippet 20:

```
for (variable of iterable object) {  
    // code to be run  
}
```

Consider some examples.

- a. **Looping over an Array** – Code Snippet 22 shows an example of looping over an array.

Code Snippet 21:

```
const webFrameworks = ["React", "Angular", "Rails", "Node.js"];
let text = "";
for (let x of webFrameworks) {
    text += x;
}
console.log(text);
```

In the code, a constant array is declared to hold several strings, in this case the names of different Web Frameworks. Then, a `for..of` loop is created to iterate through each element in the array and the elements are joined to one other to form a concatenated string, `text`. The `for..of` loop also makes use of the `let` keyword to assign each iterated value into a variable `x`.

The output of Code Snippet 22 in Figure 11.25 shows that the iterator started at the first element `React` and finished at the last `Node`. It has moved through the array and printed one element at a time.

ReactAngularRailsNode.js	script.js:8
--------------------------	-------------

Figure 11.25: Output of Looping over Array

- b. **Looping over a String** - Code Snippet 23 shows an example of looping over a string.

Code Snippet 22:

```
const line = "This is a line"
let text = "";
for (let x of line) {
    text += '"' + x + '"';
}
console.log(text);
```

The output of Code Snippet 23 in Figure 11.26 shows that each alphabet in the sentence is looped within quotation marks.

'T''h''i''s' 'i''s' 'a' 'l''i''n''e'	script.js:8
--------------------------------------	-------------

Figure 11.26: Output of Looping over String

11.8 New Features and Enhancements in JavaScript

JavaScript in recent times has evolved to include many new features and enhancements.

JavaScript Promises

Asynchronous operations in JavaScript are managed by Promises, which are a new feature in JavaScript.

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A Promise is an object that represents eventual success or failure of an asynchronous operation. Promises can handle multiple asynchronous operations easily and provide better error handling than callbacks and events. An example of implementing Promises is the fetch API that is used to retrieve data from the Internet.

The benefits of Promises are as follows:

- Improves readability of code
- Handles asynchronous operations better
- Handles errors

A Promise has four states:

- **fulfilled**: When an action related to the promise succeeds.
- **rejected**: When an action related to the promise fails.
- **pending**: When the Promise is in pending state.
- **settled**: When the Promise is fulfilled or rejected with an error message.

Promise Chain

When a callback function returns a Promise, it searches for a method, such as `then()`, `catch()`, or `finally()`. Depending on the method used, the Promise chains on another call. Hence, all successive calling methods are referred to as the promise chain.

Commonly used methods are listed in table 11.11.

Method	Description
<code>then()</code>	Returns a Promise with either success or failure.
<code>catch()</code>	Returns a Promise, but deals with rejections only.
<code>finally()</code>	Returns the Promise when it is resolved, that is either rejected or fulfilled.

Table 11.11 : Methods of Promise Chain

Figure 11.27 illustrates a Promise Chain using the common methods.

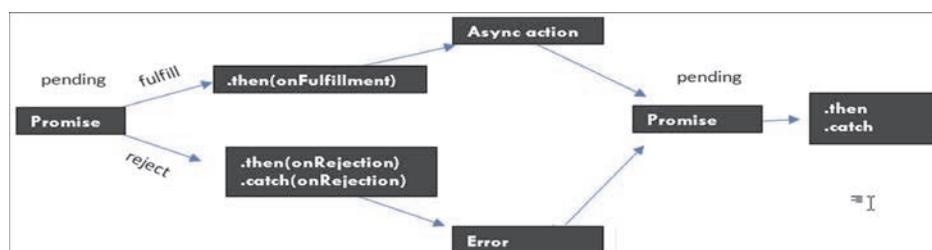


Figure 11.27: The Promise Chain

A Promise can be created using a Promise constructor: `const myPromise = new Promise();`

Code Snippet 23 shows two parameters: resolve (for success) and reject (for failure).

Code Snippet 23:

```
const myPromise = new Promise((resolve, reject) => {
    // condition
});
```

Depending on the success or failure of the Promise, further conditions can be used, as shown in Code Snippet 24.

Code Snippet 24:

```
const myPromise = new Promise((resolve, reject) => {
    let condition;
    if(condition is met) {
        resolve('Promise is resolved successfully.');
    } else {
        reject('Promise is rejected');
    }
});
```

Code Snippet 25 shows the `then()` value. If a `then()` value is included with the Promise, the Promise will be resolved till the final stage.

Code Snippet 25:

```
myPromise.then( (message) => {
    console.log(message);
});
```

Code Snippet 26 shows the `catch()` value. The `catch()` value is applicable for rejected Promises only; it returns the Promise.

Code Snippet 26:

```
myPromise.then( (message) => {
    console.log(message);
}).catch( (message) => {
    console.log(message);
});
```

Code Snippet 27 shows a complete example illustrating the JavaScript Promise feature.

Code Snippet 27:

```
<!DOCTYPE html>
<html>
<body>
```

```
<h2>Sample JavaScript Promise</h2>
<p>Wait 5 seconds (5000 milliseconds) for this page to load.</p>
<h1 id="demo"></h1>
<script>
const myPromise = new Promise(function(Resolve, Reject) {
  setTimeout(function(){ Resolve("I am an artist!!"); }, 5000);
});
myPromise.then(function(value) {
  document.getElementById("demo").innerHTML = value;
});
</script>
</body>
</html>
```

11.9 Private Class Features

When a method is classified as Private, it means that only those objects belonging to the same class can access it. By default, class fields are public. To declare a private class field, prefix the name of the class field with # (hash) tag. The # is a part of the name. Private fields can be accessed on the class constructor from within the class declaration. They are used for declaration of field names as well as for accessing a field's value.

Code Snippet 28 illustrates the procedure to create a private class field.

Code Snippet 28:

```
// Create new class
class MyClass {
  // Declare private class field
  #myPrivateField = 'This is a personal account.'
}
```

Accessing Private Class Fields/Properties with Methods

There are two ways to access a class property:

1. Create a new instance of the class and access the property on that instance.
2. Declare the property as a static property so that the class does not have to be instantiated.

To access private class fields from outside the class, one can create a new method and return the private class field from that method. The method can be defined as public or static.

If the method is public, the class must be instantiated. Then, call that method on the new instance and get the value of the private field. Static methods can be called without instantiating the class.

Code Snippet 30 illustrates the creation of a public method to access a private class field.

Code Snippet 30:

```
<!DOCTYPE html>
<html>
<body>
<script>
"use strict";
// Create new class
class MyClass {
    // Declare private class field
    #myPrivateField
    // Define public method to return the private field
    returnPrivateField() {
        // Return the value of #myPrivateField
        return this.#myPrivateField
    }
    // Define public method to update the private field
    updatePrivateField(val) {
        // Update the value of #myPrivateField
        this.#myPrivateField = val
    }
}
// Create instance of MyClass
const myInstance = new MyClass()
try {
    // Try to call myMethod() on myInstance
    myInstance.updatePrivateField('Hello')
    console.log('Success');
    // Try to access the private field directly
    myInstance.returnPrivateField()
    // Output:
    // 'Hello'
} catch(error) {
    // Log any error
    console.log(error)
}
</script>
</body>
</html>
```

Updating Private Class Fields with Methods

The same rules are applicable when updating private class fields. Use a method to call from the outside and gain access to a private class field.

Code Snippet 31 illustrates the procedure to update a private class field.

Code Snippet 31:

```
<!DOCTYPE html>
<html>
<body>
<script>
"use strict";
// Create new class
class MyClass {
    // Declare private class field
    #myPrivateField = 'This is a personal account.'
    // Define public method
    myMethod() {
        // Return the value of #myPrivateField
        return this.#myPrivateField
    }
}
// Create instance of MyClass
const myInstance = new MyClass()
try {
    // Try to call myMethod() on myInstance
    myInstance.myMethod()
    // Output:
    // 'This is a personal account.'
    // Try to access the private field directly
    myInstance.#myPrivateField
    // Output:
    // SyntaxError: Private name #myPrivateField is not defined
} catch(error) {
    // Log any error
    console.log(error)
}
</script>
</body>
</html>
```

11.10 JavaScript Object Notation

JavaScript Object Notation (JSON) is used to structure data in a minimal, readable form. It transmits data between a Web application and a server.

The two parts of JSON are keys and values. Together they make a key/value pair.

- ➔ **Key:** A string enclosed in quotation marks.
- ➔ **Value:** A value can be an array, object, string, number, or Boolean values.
- ➔ **Key/Value Pair:** A pair follows a specific syntax ("key" : "value"). Each pair is comma-separated.

Syntax: "myKey" : "myValue"

Table 11.12 lists the types of values in JSON.

Value	Description	Example
Arrays	Arrangement of one type string.	"myArray" : ["happy", "sad"]
Objects	Indicated by {}; everything within curly braces is part of the object.	"objectOne" : { "key" : "value" }
String	Text characters forming a word.	name: "myname"
Number	Identified by integers.	age: 213
Boolean Value	True or False values.	isOld: true

Table 11.12: Types of Values

Code Snippet 32 illustrates a complete JSON file representing TV show data.

Code Snippet 32:

```
{  
    "page":1,  
    "results": [  
        {  
            "first_air_date": "2005-03-26",  
            "genre_ids": [  
                28,  
                12,  
                18,  
                878  
            ],  
            "id": 57243,  
            "original_name": "Doctor Who",  
            "origin_country": [  
                "GB"  
            ],  
            "name": "Doctor Who"  
        },  
        {  
            "first_air_date": "2007-09-24",  
            "genre_ids": [  
                18,  
                35  
            ],  
            "id": 1418,  
            "original_name": "The Big Bang Theory",  
            "origin_country": [  
                "US"  
            ],  
            "name": "The Big Bang Theory"  
        }  
    ]  
}
```

```
{  
    "first_air_date": "2015-08-23",  
    "genre_ids": [  
        18,  
        27  
    ],  
    "id": 62286,  
    "original_name": "Fear the Walking Dead",  
    "origin_country": [  
        "US"  
    ],  
    "name": "Fear the Walking Dead"  
}  
],  
"total_pages": 3116,  
"total_results": 62309  
}
```

11.11 JSON Serialization and Deserialization

Serialization and Deserialization are two features in JSON that are required for saving the state of an object so that it can be created again. They are useful for storing and exchanging data.

Serialization can be defined as the process where an object is converted into a string so that it can be recreated.

Deserialization is the reverse of Serialization; where a string is converted into an object.

When data is transmitted or stored in a file, it is in byte form. However, large amounts of data are complex and cannot be stored in bytes. Hence, using serialization converts large data into bytes. Thereafter, the receiver recovers the original data from the byte string. This is called Deserialization.

For example, serializing following object:

```
{num: [2, 4, 6, 8], car: "bat"}
```

converts it into a string:

```
'{ "num": [2,4,6,8], "car": "bat" }'
```

This can be stored or sent through a network. The receiver deserializes the string to retrieve the original object: {num: [2, 4, 6, 8], car: "bat"}.

11.12 Check Your Progress

1. A JavaScript function is created under the _____ element.

(A)	script	(C)	head
(B)	body	(D)	form

2. Which of the following methods do not change values of the parameters passed to it from the calling function?

(A)	Pass By Variable	(C)	Pass By Value
(B)	Pass By Reference	(D)	Pass By Object

3. The _____ object is the parent object from which all JavaScript objects are derived.

(A)	String	(C)	Math
(B)	Object	(D)	Array

4. Match the browser objects with their respective description.

Object		Description	
(A)	window	1.	Retrieves the information of the URL loaded in the browser window
(B)	history	2.	Contains information about the browser used by the client
(C)	navigator	3.	Contains a set of URLs visited by the user in a browser window
(D)	location	4.	Represents a browser window

(A)	a-4, b-1, c-2, d-3	(C)	a-3, b-2, c-1, d-4
(B)	a-1, b-3, c-4, d-2	(D)	a-4, b-3, c-2, d-1

5. Identify the correct document object method that retrieves a collection of HTML elements using the specified name.

(A)	getElement()	(C)	getElementById()
(B)	getElementsByName()	(D)	getElementsByTagName()

6. What among the following is applicable for an event that occurs when a user clicks an element?

(A)	onclick	(C)	Onkeyup
(B)	onchange	(D)	onblur

7. Read the following code and identify the correct attribute to fetch the value entered in the username text field:

```
<body>
<form name="register">
Enter username < input value="John" id="name" name="username" >
</form>
</body>
```

(A)	document.register.name.value	(C)	document.getElementByName("name").value
(B)	document.getElementById("name").value	(D)	None of these

11.12.1 Answers

1.	A
2.	C
3.	B
4.	D
5.	B
6.	A
7.	B

Summary

- A function is reusable piece of code which performs calculations on parameters and other variables.
- The return statement passes the resultant output to the calling function after the execution of the called function.
- Objects are entities with properties and methods and resemble to real life objects.
- There are two ways to create a custom object namely, by directly instantiating the object or by creating a constructor function.
- JavaScript provides various built-in objects, such as String, Math, and Date.
- JavaScript also provides browser objects, such as window, history, location, and navigator.
- DOM is a standard technique for dynamically accessing and manipulating HTML elements.
- The DOM provides a document object which is used within JavaScript to access all HTML elements presented on the page.

Try It Yourself

1. Create a Website for an online store that allow their customers to buy music and movie CDs and DVDs over the Internet. For online shopping, Website accepts the credit card details from the customer. These credit card details should be validated before allowing the customers to proceed further.

Assume that you are one of the developer and have to perform following tasks:

- Create a Web page that displays images of movie CDs and DVDs. On click of any image, a new window is opened displaying details of the selected movie.
- Create a Web page with a form containing appropriate controls that allow customers to input their credit card number.
- Check the credit card details. If the credit card details do not match, an alert box must be displayed stating the same.
- Allow the customers to navigate through the Website by providing the Next, Previous, Top, and Bottom buttons.
- Allow the customers to maintain the history of URLs visited in a browser window.

Hint: To fulfill these requirements, the developer can make use of the DOM objects.

2. Create a Web page with a label and a button named `fade`. When user clicks button, the label along with the text must disappear and again on second click, the label should reappear.
3. Create a expand and collapse panel with a button using HTML, CSS, and JavaScript. Initially, the panel will be in the expanded mode. When user clicks button, the panel will be collapsed and only a bar along with a button is visible. Similarly, when the user clicks button next time, the panel is expanded.



Session - 12

ECMAScript 2022 and its New Features

Welcome to the Session, **ECMAScript 2022 and its New Features**.

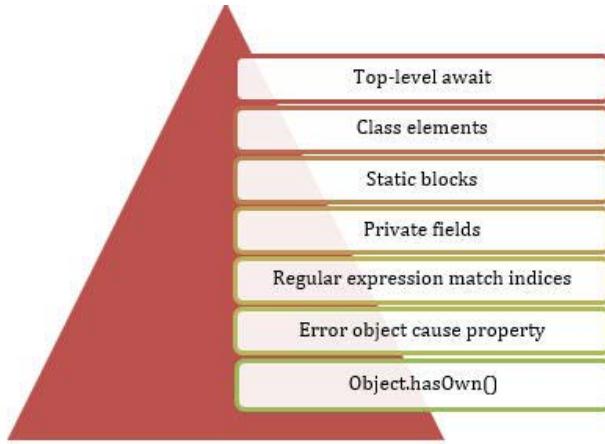
This session introduces the latest version of the ECMAScript language specification, ECMAScript 2022.

In this Session, you will learn to:

- ➔ Describe new features and improvements in ECMAScript 2022
- ➔ Describe Top-level await
- ➔ Explain static class initialization blocks

12.1 Basics of ECMAScript 2022

The 13th version of ECMAScript language was released in June 2022. It is also known as ES2022. It has several new features and improvements over its prior version. Some features of ECMAScript 2022 are as follows:



Top-level await – This feature allows the await keyword to be at the top level of modules, outside of a function. In prior versions, await was allowed only within async functions.

Class elements – ES2022 introduced several new class elements. This includes public and private instance fields, public and private static fields, private instance methods and accessors, and private static methods and accessors. This provides the developers with good control over the encapsulation of class data and behavior.

Static blocks – ES2022 has introduced static blocks inside the classes. This provides more flexibility in class initialization as they allow per-class evaluation initialization. This helps developers write more modular and maintainable code as complex initialization logic is encapsulated within the class itself.

Private fields – Private fields can only be accessed within the class itself and not from outside the class or its instances. The ES2022 has introduced the # character to define the private instance fields.

Regular expression match indices – The /d flag provides start and end indices for matched substrings.

Error object cause property – This is a feature provided in ES2022 that identifies the causation chain in errors. This makes it easy to trace the source of an error.

Object.hasOwn() – `Object.hasOwn()` method returns a Boolean value. It is bound to replace `Object.prototype.hasOwnProperty()`.

12.2 Top-level await

Top-level await is one of the important features introduced in ECMAScript 2022. With the introduction of this feature, the await keyword can be put outside of an async function without the necessity for an enclosing async function. This is different from its preceding versions. Before top-level await, it was challenging for developers to write more straightforward code that would rely on asynchronous data during module initialization.

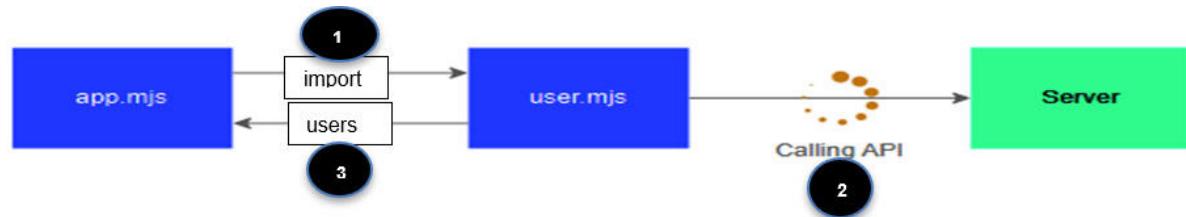


Figure 12.1: Top-Level Await

As can be seen from Figure 12.1, `app.mjs` utilizes top-level await to import data from `user.mjs`, which in turn uses top-level await to fetch user data in JSON format from an external API. Of note, `.mjs` is extension for JavaScript modules.

Code Snippet 1 shows an example of top level await.

Code Snippet 1:

```
const response = await fetch('https://jsonplaceholder.typicode.com/todos/1');
const data = await response.json();
console.log(data);
```

This is a JavaScript code snippet to fetch data from a JSON API to retrieve a to-do item with an ID of 1 and then log the response. Without top-level await, it would be necessary to wrap the `fetch` and JSON parsing operations in an `async`.

The top-level await is a very good feature, but is not yet supported in all environments. It can slow down the startup time of the application. In some performance-critical functions, it is recommended to apply this feature cautiously.

12.3 Class Static Initialization Blocks

The Class Static Initialization Blocks is a feature introduced in ECMAScript 2022. They define a block of code that is executed when a class is first loaded by the runtime environment. The `static` initialization blocks provide a way to initialize static properties in a more flexible manner. Static initialization blocks are enclosed in braces and are defined using the `static` keyword. Each class with static initialization blocks is evaluated in the order of their declaration.

Code Snippet 2 illustrates the application of static initialization block.

Code Snippet 2:

```
class MyClass {
  static {
    // This code will run when the class is defined
    console.log('MyClass is being defined!');
  }

  // Other class members go here
}
```

Here, a static class initialization block logs a message to the console. When the class is defined, the code inside the block runs before any other class members are defined or instantiated.

It is worth noting that static class initialization does not support all the environments yet. Thus, a thorough check on the compatibility is a must before development to avoid any unexpected behavior.

12.4 Object.hasOwn()

The `Object.hasOwn()` property, a feature in ECMAScript 2022, is a replacement for `Object.hasOwnProperty()`. It is a static method that returns a Boolean value, that is, true if an object has a specific property as its own. However, if the property is inherited it returns false value. To understand `Object.hasOwn()` property, consider Code Snippet 3.

Code Snippet 3:

```
<SCRIPT>
const object1 = {
  prop: 'exists'
};
console.log(Object.hasOwn(object1, 'prop'));
console.log(Object.hasOwn(object1, 'toString'));
console.log(Object.hasOwn(object1, 'undeclaredPropertyValue'));
</SCRIPT>
```

Here, `Object.hasOwn()` is checks if `object1` has the properties `prop`, `toString`, and `undeclaredPropertyValue`. The method returns true for `prop`, because it is a direct property of `object1`. It returns false for `toString` and `undeclaredPropertyValue`, because they are not direct properties of `object1`.

The output is illustrated in Figure 12.2.

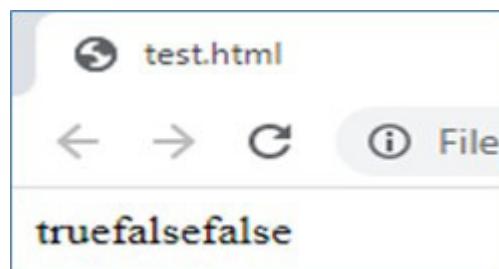


Figure 12.2: Output of `Object.hasOwn()`

12.5 RegExp: `match .indices ('d' flag)`

The `d` flag is a new addition to the regular expression syntax in ECMAScript 2022. This allows the `.matchAll()` method to return the matches along with their indices in the input string. The `d` flag is

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appended to the end of the regular expression literal. Code Snippet 4 shows how the d flag enables the `.matchAll()` method to return both the matches and their indices in the input string.

Code Snippet 4:

```
const regex = /foo\d+/d;  
const str = 'foo123 bar456 foo789';  
  
for (const match of str.matchAll(regex)) {  
    console.log(match);  
}
```

In this example, the d flag enables the `.matchAll()` method to return both the matches and their indices in the input string. The regular expression `/foo\d+/d` matches any string that starts with foo followed by one or more digits. The match object returned by the `.matchAll()` method contains the matched substring (`match[0]`), the starting index of the match (`match.index`), and the ending index of the match (`match.indices[0][1]`).

It is important to note that the d flag applied in the regular expression is not yet supported in all JavaScript engines. Therefore, it is recommended to check the compatibility of the flag before utilizing it in production code. Moreover, enabling the d flag can impact the performance of the regular expression matching process, especially when dealing with large input strings. Therefore, it is important to utilize the d flag judiciously, considering the tradeoff between the convenience it provides and the performance implications it can have.

12.6 Check Your Progress

1. Identify the ECMA 2022 element that is created with # prefix.

(A)	Encapsulation	(C)	Private fields
(B)	Protected fields	(D)	Final fields

2. Identify the feature of Class Static Initialization Blocks in ECMAScript 2022.

(A)	They execute a block of code when an instance of a class is created.	(C)	They are evaluated in random order.
(B)	They provide a way to initialize instance properties in a more flexible manner.	(D)	They are defined using the static keyword and enclosed in braces.

3. Which of the following statement is true for top-level await in ECMAScript 2022?

(A)	The await keyword can only be used inside an async function.	(C)	Top-level await was available in previous versions of ECMAScript.
(B)	Top-level await allows for the usage of asynchronous data during module initialization.	(D)	Top-level await can only be used with Promise objects.

4. Which of the following statement is true about the Object.hasOwn() property in ECMAScript 2022?

(A)	It only returns true if an object has a specific property as its own and not if it is inherited.	(C)	It is a dynamic method that returns a Boolean value indicating if an object has a specific property as its own or inherited.
(B)	It is a static method that returns a Boolean value indicating if an object has a specific property as its own or inherited.	(D)	It is a replacement for the Object.assign() method.

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5. Identify the statements is true about the d flag in ECMAScript 2022.

(A)	It is used to replace all occurrences of a pattern in a string.	(C)	It is used to specify that the regular expression should match only at the beginning of the input string.
(B)	It is used to specify that the regular expression should match only at the end of the input string.	(D)	It is used to return the matches along with their indices in the input string using the .matchAll() method.

12.6.1 Answers

1.	C
2.	D
3.	B
4.	A
5.	D

Summary

- ➔ ECMAScript 2022 is the 13th version of the ECMAScript language released in June 2022.
- ➔ Private field is a feature in ECMAScript that allows developers to define private properties in classes that are encapsulated and not directly accessible from outside the class.
- ➔ The static initialization blocks provide a way to initialize static properties in a more flexible manner.
- ➔ Object.hasOwn() property is a static method that is a replacement for Object.hasOwnProperty() and returns a Boolean value indicating if an object has a specific property as its own.
- ➔ The d flag in regular expressions is a new addition that allows the .matchAll() method to return the matches along with their indices in the input string.

Try it Yourself

Make a form that requests the user's password and email address. Before submitting the form, verify the email address and password using RegExp. Use a '@' sign and a legitimate domain name in the email address, following the guidelines for conventional email addresses. Choose a pattern for the password that includes at least one of each: an uppercase letter, a lowercase letter, and a number.



Session - 13

Canvas and Web Storage in HTML5

Welcome to the Session, **Canvas and Web Storage in HTML5**.

This session describes the new <canvas> element in HTML5. It also explores the procedure to draw lines, use color, and transparency in Web pages. This session further explains how to work with drawing objects, images, text, and create Web page events with JavaScript and jQuery. This session explains about Web storage API that provides functionality for storing data on client-side. The session also explains Indexed DB API which allows hosting of Web databases locally within the user's browser.

Further, the session explains differences between native apps and HTML5 apps. Finally, it explores the process of converting HTML5 apps to native apps.

In this Session, you will learn to:

- Describe Canvas in HTML5
- Explain the procedure to draw lines
- Explain the procedure to use color and transparency
- Explain the procedure to work with various drawing objects, images, and text
- Describe the procedure to create Web page events with JavaScript and jQuery
- Describe the process of including external content in Web pages
- Explain Web storage in HTML5
- Explain session storage and local storage
- Explain Indexed DB API
- Describe a native app
- Explain difference between native apps and HTML5 apps
- Describe advantages of native and HTML5 apps
- List steps to convert HTML5 apps to native apps

13.1 Introduction

Canvas is one of the most interesting features added in HTML5. The `<canvas>` element supports advanced graphics and interactions in many forms. In earlier versions of HTML, you could achieve this by using plug-ins. Using the `<canvas>` element eliminates the requirement for such plug-ins and makes working with graphics easier and more efficient. The `<canvas>` element is a drawing area where the user can draw graphics, use images, add animations, and also add text for enhancing the user experience on Web pages.

13.2 Canvas Element

The `<canvas>` element in HTML5 can be used to draw much more than just rectangles on Websites - it can be used to dynamically draw graphics using JavaScript. This improves the overall performance of Websites and avoids the requirement to download images from the sites. The `<canvas>` element is represented like a rectangle on a page and allows the user to draw arcs, text, shapes, gradients, and patterns. By using `<canvas>`, the user can draw many complex shapes and also apply various effects and transformations.

The `<canvas>` in HTML5 is similar to the `<div>`, `<table>`, or `<a>` tag except that the content used in it is rendered through JavaScript.

The `<canvas>` element is simple and easy to use with JavaScript. The `<canvas>` element does not contain any drawing abilities, instead, the drawing is done using a JavaScript code. To make use of the `<canvas>` element, a user has to add the `<canvas>` tag on the HTML page.

Code Snippet 1 demonstrates the use of `<canvas>` element.

Code Snippet 1:

```
<!DOCTYPE HTML>
<html>
<head>
<title>Canvas </title>
<style>
    canvas{border: medium double red; margin: 4px}
</style>
</head>
<body>
<canvas width="278" height="200"></canvas>
</body>
</html>
```

In the code, the `<style>` element is used to display the border of the `<canvas>` element. The `height` and `width` attributes specify the size of the `<canvas>` element on the page.

Figure 13.1 displays the `<canvas>` element.

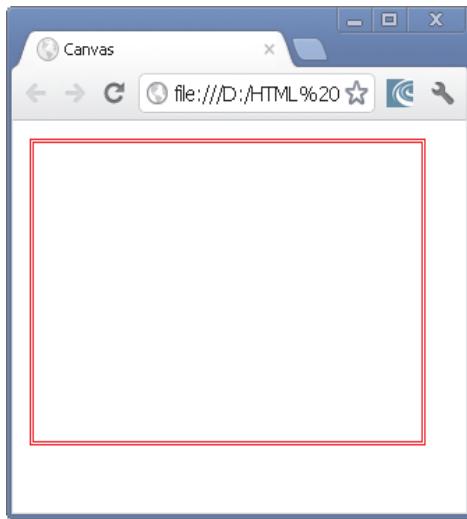


Figure 13.1: <Canvas> Element

To draw a `<canvas>` element, the user can use a context object. The context object contains the drawing functions for a specific style of graphics. Two-Dimensional (2d) context is used to work with 2d operations.

The `<canvas>` element in DOM exposes the `HTMLCanvasElement` interface. This interface provides the methods and properties for changing the presentation and layout of canvas elements. The `HTMLCanvasElement` has a `getContext(context)` method that returns the drawing context for the canvas.

Code Snippet 2 demonstrates the 2d context object for the canvas.

Code Snippet 2:

```
<!DOCTYPE HTML>
<html>
<head>
<title> Canvas </title>
<script>
window.onload=function() {
var canvas=document.getElementById('mCanvas');
var ctext=canvas.getContext('2d');
ctext.beginPath();
ctext.rect(18, 50, 200, 100);
ctext.fillStyle="DarkBlue";
ctext.fill();
};
</script>
</head>
<body>
```

```
<canvas id="mCanvas" width="578" height="200"></canvas>
</body>
</html>
```

In the code, the `height` and `width` attributes define the height and width of the `canvas` element respectively. In the initializer function, the DOM object is accessed through the `id` attribute and gets a 2d context by using the `getContext()` method. Here, the rectangle is created by using the `rect(18, 50, 200, 100)` method with `x, y, height, and width` parameters and is positioned at left corner of the page.

Figure 13.2 displays the canvas.

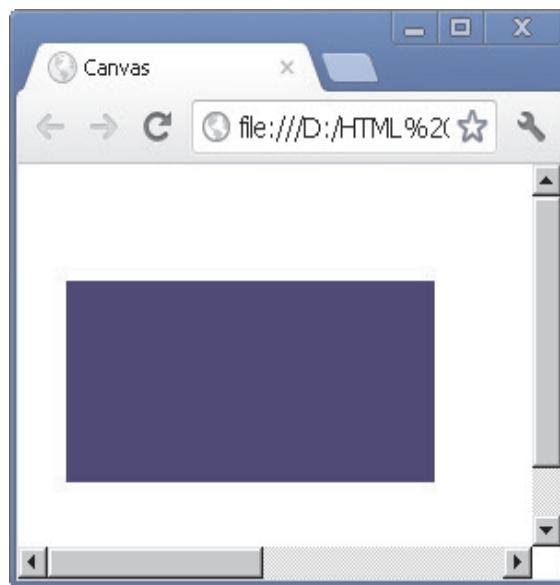


Figure 13.2: Canvas

13.3 Drawing a Line in Canvas

You can create lines in a canvas using the `stroke()`, `beginPath()`, `lineTo()`, and `moveTo()` methods.

Following is the syntax to create a line in canvas:

Syntax:

```
ctext.beginPath();
ctext.moveTo(x, y);
ctext.lineTo(x, y);
ctext.stroke()
```

where,

`ctext` - specifies a context object

`beginPath()` - Specifies a new drawing path

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`moveTo()` - Specifies the creation of new sub path to the given position

`lineTo()` - Specifies the drawing of a line from the context position to the given position

`stroke()` - Specifies how to assign a color to the line and display it

Code Snippet 3 demonstrates creating a line in HTML5 canvas.

Code Snippet 3:

```
<!DOCTYPE HTML>
<html>
<head>
<title>Line</title>
<style>
body {
    margin: 0px;
    padding: 0px;
}
#mCanvas {
    border: 1px solid red;
}
</style>
<script>
window.onload = function() {
    var canvas = document.getElementById("mCanvas");
    var ctext = canvas.getContext("2d");
    ctext.beginPath();
    ctext.moveTo(100, 150);
    ctext.lineTo(250, 50);
    ctext.lineWidth = 5;
    ctext.strokeStyle = "blue";
    ctext.stroke();
};
</script>
</head>
<body>
<canvas id="mCanvas" width="360" height="200"></canvas>
</body>
</html>
```

In the code, `height` and `width` attributes are defined. The initializer function has the DOM object which is accessed through the `id` attribute and gets a `2d` context by using `getContext()` method.

The `beginPath()` method is called through the context object to draw the path of the line. The `moveTo(100, 150)` method is called that creates a new path for the given point to place the drawing cursor. This method moves the position of the window to the upper-left corner by giving the `x` and `y` coordinates. The `lineTo(250, 50)` method is called to draw the line from the context point to given point. The `lineWidth` property is specified as 5 to define the width of the line on the canvas. The `strokeStyle` property sets the color of the line to blue. The `stroke()` method assigns the color to the line. Figure 13.3 displays a line drawn in a canvas.

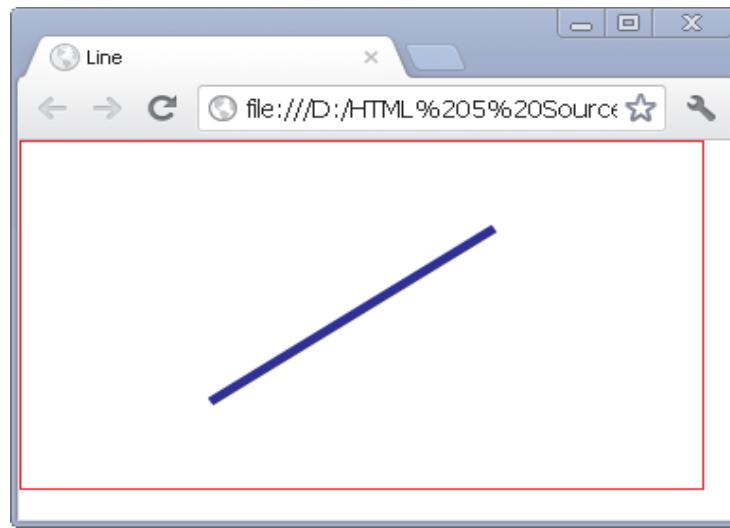


Figure 13.3: Line Drawn in a Canvas

13.4 Working with Drawing Objects in Canvas

HTML5 canvas allows the user to work with different types of drawing objects. Following objects can be drawn on a canvas element:

→ Rectangle

With HTML5 canvas, the user can create a rectangle using the `rect()` method. The HTML5 canvas is placed by using the `x` and `y` parameters and appropriately sized through `height` and `width` properties. There is a collection of methods and properties that are used to draw different types of shapes. Table 13.1 lists common properties and methods of various shapes.

Properties and Methods	Description
<code>fillStyle</code>	The values can be gradient, pattern, or a CSS color. The default property style is solid black, but the user can set the color according to the requirements.
<code>fillRect(x, y, width, height)</code>	Enables the user to draw a rectangle with the existing fill style.
<code>strokeStyle()</code>	The values can be gradient, pattern, or a CSS color.
<code>strokeRect(x, y, width, height)</code>	Enables the user to draw a rectangle with the existing stroke style. This property is used to draw the edges of the rectangle.

Properties and Methods	Description
clearRect(x, y, width, height)	Used to clear the pixels in a rectangle.

Table 13.1: Common Properties and Methods of Various Shapes

Code Snippet 4 demonstrates how to create a rectangle in HTML5 canvas.

Code Snippet 4:

```
<!DOCTYPE HTML>
<html>
<head>
<style>
#mCanvas {
    border: 1px solid green;
}
body {
    margin: 0px;
    padding: 0px;
}
</style>
<script>
window.onload=function() {
    var canvas=document.getElementById('mCanvas');
    var ctext=canvas.getContext('2d');
    ctext.beginPath();
    ctext.rect(30, 50, 150, 100);
    ctext.fillStyle="Magenta";
    ctext.fill();
    ctext.lineWidth=5;
    ctext.strokeStyle='black';
    ctext.stroke();
};
</script>
</head>
<body>
<canvas id="mCanvas" width="278" height="200"></canvas>
</body>
</html>
```

In the code, the height and width attributes are defined. The initializer function has the DOM

object which is accessed through the `id` attribute and gets a 2d context by using the `getContext()` method. The `beginPath()` method is called through the context object to draw the rectangle. The `rect(30, 50, 150, 100)` method takes `x, y, height, and width` as the parameters. The `fillStyle` property fills the rectangle with magenta color. The `fill()` method is used to paint the rectangle. The `lineWidth` property is specified as `5` to define the width of line on the canvas. The `strokeStyle` property sets the stroke style of the rectangle to black. The `stroke()` method assigns the color to the rectangle.

Figure 13.4 displays a rectangle drawn on the canvas.

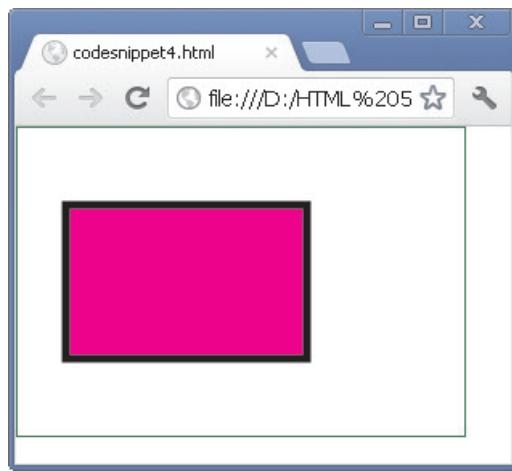


Figure 13.4: Rectangle Drawn on the Canvas

→ **Arcs**

With HTML5 canvas, the user can create an arc by using the `arc()` method. Arcs are represented using a start angle, an end angle, a radius, a center point, and the drawing direction (anticlockwise or clockwise).

The syntax to draw an arc in HTML5 is as follows:

Syntax:

`arc(x, y, radius, startAngle, endAngle, anticlockwise)`

where,

`x, y` - Specifies the coordinates of the center of an arc

`radius` - Specifies the distance from the center to any point on the circle

`startAngle, endAngle` - Specifies the start and end points in the arc

`anticlockwise` - Draws the arc clockwise or anticlockwise and accepts a boolean value

Code Snippet 5 demonstrates how to create an arc in HTML5 canvas.

Code Snippet 5:

```
<!DOCTYPE HTML>
<html>
<head>
```

```
<style>
body {
    margin: 0px;
    padding: 0px;
}
#mCanvas {
    border: 1px solid black;
}
</style>
<script>
window.onload=function() {
    var canvas = document.getElementById("mCanvas");
    var ctext = canvas.getContext("2d");
    var x = canvas.width / 2;
    var radius = 75;
    var startAngle = 1.1 * Math.PI;
    var endAngle = 1.9 * Math.PI;
    var ctrClockwise = false;
    ctext.beginPath();
    ctext.arc(x, y, radius, startAngle, endAngle, ctrClockwise);
    ctext.lineWidth = 25;
    // line color
    ctext.strokeStyle = "DarkGreen";
    ctext.stroke();
}
</script>
</head>
<body>
<canvas id="mCanvas" width="278" height="250"></canvas>
</body>
</html>
```

In the code, the `beginPath()` method is called through the context object to draw an arc by using the `arc()` method which has `x`, `y`, and `radius` as the parameters. The `x` and `y` are the coordinates of the circle, `radius` is the distance from the center to draw the arc on the canvas. The `startAngle` and the `endAngle` are the start and end points of the `arc` respectively. The `anticlockwise` specifies the direction of the arc between the two start and end points.

Figure 13.5 displays an arc in HTML5 canvas.

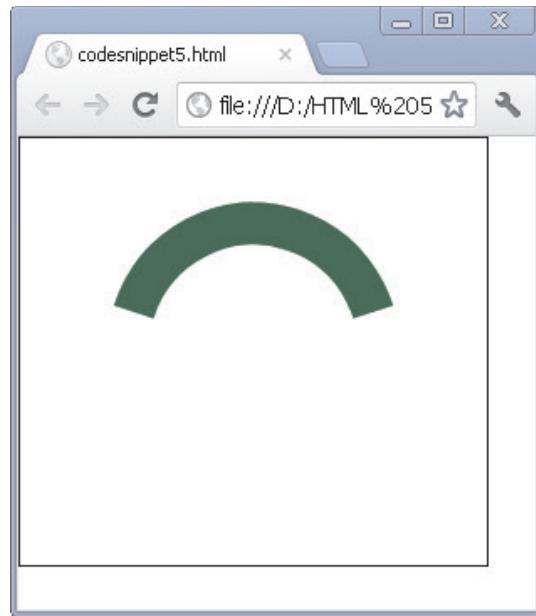


Figure 13.5: Arc in HTML5 Canvas

→ Circle

In HTML5, you can draw a circle using the `arc()` method. You have to set the start angle with `0` and the end angle is specified as `2 * PI`.

Following is the syntax to draw a circle in HTML5 is as follows:

Syntax:

```
arc(x, y, radius, startAngle, endAngle, anticlockwise)
```

where,

`x, y` - Specifies the coordinates of the center of a circle

`radius` - Specifies the distance from the center to any point on the circle

`startAngle, endAngle` - Specifies the start and end points in the circle

`anticlockwise` - Draws the circle clockwise or anticlockwise and accepts a boolean value

Code Snippet 6 demonstrates how to create a circle using HTML5.

Code Snippet 6:

```
<!DOCTYPE HTML>
<html>
<head>
<style>
body {
    margin: 0px;
```

```
padding: 0px;
}
#mCanvas {
    border: 1px solid blue;
}
</style>
<script>
window.onload = function() {
    var canvas = document.getElementById("mCanvas");
    var ctext = canvas.getContext("2d");
    var ctrX = canvas.width / 2;
    var ctrY = canvas.height / 2;
    var radius = 70;
    ctext.beginPath();
    ctext.arc(ctrX, ctrY, radius, 0, 2 * Math.PI, false);
    ctext.fillStyle = "DarkOrchid";
    ctext.fill();
    ctext.lineWidth = 4;
    ctext.strokeStyle = "black";
    ctext.stroke();
};
</script>
</head>
<body>
<canvas id="mCanvas" width="356" height="150"></canvas>
</body>
</html>
```

In the code, a circle is defined by using the `arc()` method which has `ctrX`, `ctrY`, and `radius` as the parameters. To define the arc with the points the `startAngle` is set to 0 and the `endAngle` is specified as `2*PI`. The `anticlockwise` defines the direction of the path of an arc between the two start and end points.

Figure 13.6 displays a circle in HTML5 canvas.

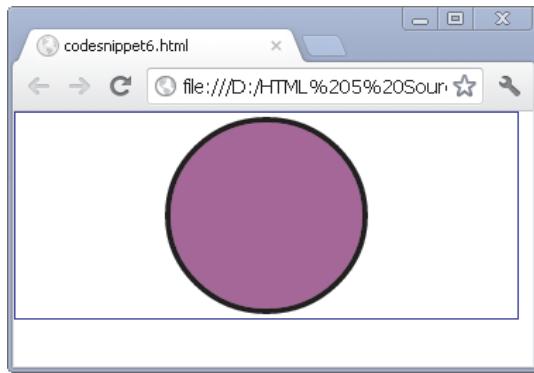


Figure 13.6: Circle in HTML5 Canvas

→ Bezier Curves

Using HTML5 canvas, you can create a Bezier curve using the `bezierCurveTo()` method. Bezier curves are represented with the two control points, context points, and an end point.

Code Snippet 7 demonstrates how to create a Bezier curve using HTML5.

Code Snippet 7:

```
<!DOCTYPE HTML>
<html>
<head>
<style>
body {
    margin: 0px;
    padding: 0px;
}
#mCanvas {
    border: 1px solid maroon;
}
</style>
<script>
window.onload=function() {
    var canvas=document.getElementById("mCanvas");
    var ctext=canvas.getContext("2d");
    ctext.beginPath();
    ctext.moveTo(188, 130);
    ctext.bezierCurveTo(140, 10, 388, 10, 288, 100);
    ctext.lineWidth=15;
    // line color
    ctext.strokeStyle="purple";
}
```

```
    ctext.stroke();
}
</script>
</head>
<body>
<canvas id="mCanvas" width="378" height="200"></canvas>
</body>
</html>
```

In the code, the Bezier curve uses the `bezierCurveTo()` method. This method defines the current context point, two control points, and an end point. The context point uses the `moveTo()` method. The first portion of the curve is tangential to the imaginary line defined in the context point and first control point. The second portion of the curve is tangential to the imaginary line which is defined by the second control point and the ending point.

Figure 13.7 displays a Bezier curve in canvas.



Figure 13.7: Bezier Curve in Canvas

→ Quadratic Curves

HTML5 canvas allows the user to create quadratic curves using the `quadraticCurveTo()` method. Quadratic curves are represented through the context point, an end point, and a control point.

Code Snippet 8 demonstrates how to create a quadratic curve using HTML5.

Code Snippet 8:

```
<!DOCTYPE HTML>  
<html>  
<head>  
<style>  
    body {
```

```
margin: 0px;
padding: 0px;
}
#mCanvas {
border: 1px solid #9C9898;
}
window.onload=function() {
var canvas = document.getElementById("mCanvas");
var ctext = canvas.getContext("2d");
ctext.beginPath();
ctext.moveTo(178, 150);
ctext.quadraticCurveTo(220, 0, 320, 150);
ctext.lineWidth = 15;
// line color
ctext.strokeStyle = "Fuchsia";
ctext.stroke();
};
</script>
</head>
<body>
<canvas id="mCanvas" width="378" height="200"></canvas>
</body>
</html>
```

In the code, the control point defines the curve of the quadratic by two tangential lines that are connected to both the context point and the end point. The context point is represented using the `moveTo()` method. This method moves the control point from the context point and the end point to create a sharper curve. It also moves the control point close to the context point and end point to create broad curves.

Figure 13.8 displays a quadratic curve in a canvas.

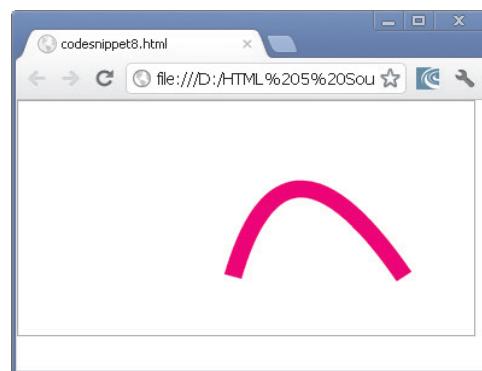


Figure 13.8: Quadratic Curve in a Canvas

13.5 Working with Images

In HTML5, the user can draw image objects on canvas using the `drawImage()` method. The `drawImage()` method can also draw parts of an image and increase or reduce the size of the image. This method accepts nine parameters, depending on editing that is required on the image. The image object can be a video, an image, or another canvas element.

Code Snippet 9 demonstrates how to create an image using HTML5.

Code Snippet 9:

```
<!DOCTYPE HTML>
<html>
<head>
<style>
body {
margin: 0px;
padding: 0px;
}
#mCanvas {
border: 1px solid #9C9898;
}
</style>
<script>
window.onload=function() {
var canvas = document.getElementById("mCanvas");
var ctext=canvas.getContext("2d");
var imgObj = new Image();
imgObj.onload=function() {
ctext.drawImage(imgObj, 69, 50);
};
imgObj.src = "bird.jpg";
}
</script>
</head>
<body>
<canvas id="mCanvas" width="368" height="300"></canvas>
</body>
</html>
```

In the code, the `onload` property is used. The source of the object is defined by using the `src` property. The image has to be loaded first and then, instantiated with the `drawImage()` method.

This method takes image object as the parameter with the `x` and `y` coordinates of the image.

Figure 13.9 displays an image drawn on a HTML5 canvas.



Figure 13.9: Image Drawn on a HTML5 Canvas

You can also set the size of the image by adding two parameters `width` and `height` to the `drawImage()` method.

Code Snippet 10 demonstrates how to resize images with `height` and `width` attributes using HTML5.

Code Snippet 10:

```
<!DOCTYPE HTML>
<html>
<head>
<style>
body {
    margin: 0px;
    padding: 0px;
}
#mCanvas {
    border: 1px solid black;
}
</style>
<script>
window.onload = function() {
    var canvas = document.getElementById("mCanvas");
    var ctext = canvas.getContext("2d");
    var x = 69;
    var y = 50;
```

```
var w=150;
var h=137;
var imgObj = new Image();
imgObj.onload=function() {
ctext.drawImage(imgObj, x, y, w, h);
};
imgObj.src = "bird.jpg";
};

</script>
</head>
<body>
<canvas id="mCanvas" width="278" height="200"></canvas>
</body>
</html>
```

In the code, the `drawImage()` method accepts two additional parameters `height` and `width` for resizing the image.

Figure 13.10 displays resizing an image in a HTML5 canvas.



Figure 13.10: Resizing an Image in a HTML5 Canvas

13.6 Working with Text

HTML5 canvas enables you to set the font, style, and size of text by using the `font` properties. The `font` style can be `italic`, `normal`, or `bold`. For setting the text color, you can use the `fillStyle` property of the canvas.

Code Snippet 11 demonstrates how to set the font, size, style, and color of the text on a HTML5 canvas.

Code Snippet 11:

```
<!DOCTYPE HTML>
<html>
<head>
<style>
body {
margin: 0px;
padding: 0px;
}
#mCanvas {
border: 1px solid blue;
}
</style>
<script>
window.onload=function() {
var canvas=document.getElementById("mCanvas");
var ctext=canvas.getContext("2d");
ctext.font="italic 30pt Calibri";
ctext.fillStyle="MediumVioletRed";
ctext.fillText("Welcome to HTML5!", 40, 100);
};
</script>
</head>
<body>
<canvas id="mCanvas" width="380" height="170"></canvas>
</body>
</html>
```

In the code, the font text is specified as Calibri, style as italic, and size is set to 30pt. The fillStyle property specifies the text color and the fillText property is used to set the text on the canvas.

Figure 13.11 displays the working with text in a HTML5 canvas.



Figure 13.11: Working with Text in a HTML5 Canvas

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In HTML5 canvas, the user can set the stroke color by using the `strokeText()` method and `strokeStyle` property of the canvas context.

Code Snippet 12 demonstrates the use of stroke text in HTML5 canvas.

Code Snippet 12:

```
<!DOCTYPE HTML>
<html>
<head>
<style>
body {
    margin: 0px;
    padding: 0px;
}
#mCanvas {
    border: 1px solid black;
}
</style>
<script>
window.onload = function() {
var canvas = document.getElementById("mCanvas");
    var ctext = canvas.getContext("2d");
    var x = 80;
    var y = 110;
    ctext.font = "40pt Calibri";
    ctext.lineWidth = 2;
    // stroke color
    ctext.strokeStyle = "Brown";
    ctext.strokeText("HTML5", x, y);
};
</script>
</head>
<body>
<canvas id="mCanvas" width="360" height="200"></canvas>
</body>
</html>
```

In the code, the stroke color is set by using the `strokeStyle` property and the `strokeText()` method.

Figure 13.12 displays the stroke text in HTML5 canvas.



Figure 13.12: Stroke Text in HTML5 Canvas

13.7 Using Transparency for Text in Canvas

There are two ways to set the transparency for the text and shapes. The first method is to use the `strokeStyle` and `fillStyle` by using the `rgb` function. The second method is to use `globalAlpha` drawing state property, which can be applied universally. The `globalAlpha` property is a value that ranges between 0 (fully transparent) and 1 (fully opaque).

Code Snippet 13 demonstrates the use of `globalAlpha` property.

Code Snippet 13:

```
<!DOCTYPE HTML>
<html>
<head>
<style>
body {
    margin: 0px;
    padding: 0px;
}
#mCanvas {
    border: 1px solid black;
}
</style>
<script>
window.onload = function() {
    var canvas = document.getElementById("mCanvas");
    var ctext = canvas.getContext("2d");
    ctext.fillStyle = "Indigo";
    ctext.strokeStyle = "black";
    ctext.lineWidth = 2;
    ctext.font = "italic 30pt Calibri";
    ctext.fillText("HTML5", 40, 100);
}
```

```
ctext.strokeText ("HTML5", 40, 100);
ctext.fillStyle="blue";
ctext.globalAlpha=0.5;
ctext.fillRect(100, 10, 150, 100);
};

</script>
</head>
<body>
<canvas id="mCanvas" width="350" height="170"></canvas>
</body>
</html>
```

In the code, the `fillStyle` and `strokeStyle` is used to color the text. The 'HTML5' text `lineWidth` is specified as 2 and the `font-family` is set to `Calibri` with `italic` style and font-size to 30pt. The `fillText` property fills the color and `strokeText` property applies the stroke color to the HTML5 text. The `fillStyle` is set to blue and `globalAlpha` property is set to 0.5. The `fillRect(100, 10, 150, 100)` specifies the x, y, height, and width of the rectangle.

Figure 13.13 displays the transparency in text.

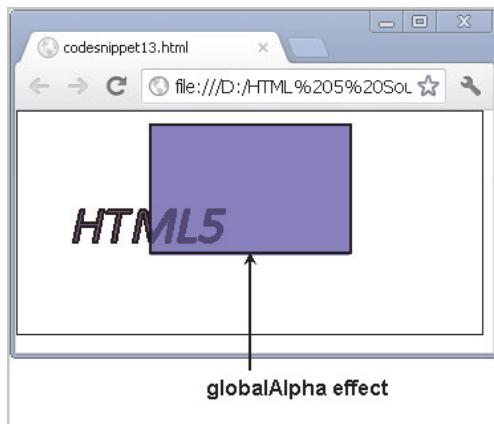


Figure 13.13: Transparency in Text

13.8 Using Events with jQuery

jQuery also offers different events to deal with common interactions when the user moves the mouse or switch between two actions while clicking.

Following are the events:

→ **hover() event**

The `mouseenter` and `mouseleave` are the two events often used together. For example, when a user moves a mouse over a menu, a tooltip appears and when the user moves the mouse off the menu, the tooltip disappears. Combining these two events is very common, therefore, jQuery

provides a `hover()` function that accepts two parameters. The first parameter executes when the mouse moves over the element and the second function executes when the mouse moves away from the element.

Code Snippet 14 demonstrates the hover event.

Code Snippet 14:

```
<!DOCTYPE html>
<html>
<head>
<script src="jquery-1.7.2.min.js"></script>
<script>
$(document).ready(function() {
  $("p").hover(function() {
    $("p").css("background-color", "red");
  }, function() {
    $("p").css("background-color", "maroon");
  });
});
</script>
</head>
<body>
<p>Hover the mouse on this line.</p>
</body>
</html>
```

In the code, the `hover()` method is used. When the mouse is placed on the text, then the background color changes to red. Similarly, when the user moves the mouse outside the text, the background-color changes to maroon.

Figure 13.14 displays the mouseenter effect.

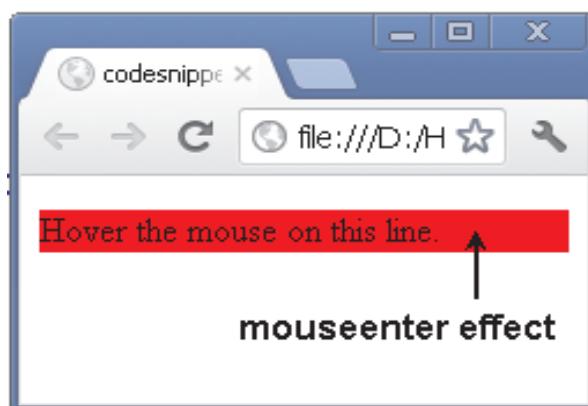


Figure 13.14: Mouseenter Effect

Figure 13.15 displays the mouseleave effect.

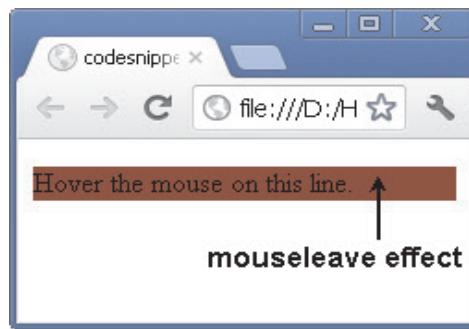


Figure 13.15: Mouseleave Effect

→ **The toggle() event**

The `toggle()` event works in a similar manner as that of the `hover()` event, except that it responds to mouse clicks. The `toggle()` function accepts more than two functions as arguments. For example, you want to perform some action on the first click, another action on the second click, and one more action on the third click. All the functions passed to the `toggle()` event will react to its corresponding click action. Code Snippet 15 demonstrates the toggle event.

Code Snippet 15:

```
<!DOCTYPE html>
<html>
<head>
<script src="jquery-1.7.2.min.js"></script>
<script>
$(document).ready(function() {
  $("p").toggle(function(){
    $("body").css("background-color","blue");
  },
  function(){
    $("body").css("background-color","pink");
  },
  function(){
    $("body").css("background-color","grey");
  });
});
</script>
</head>
<body>
<p>Click to change the colors.</p>
</body>
</html>
```

In the code, the `toggle()` method is used. When the user clicks the text then the background-color of the document is changed to blue, pink, and grey respectively.

Figure 13.16 displays the toggle effect to blue.

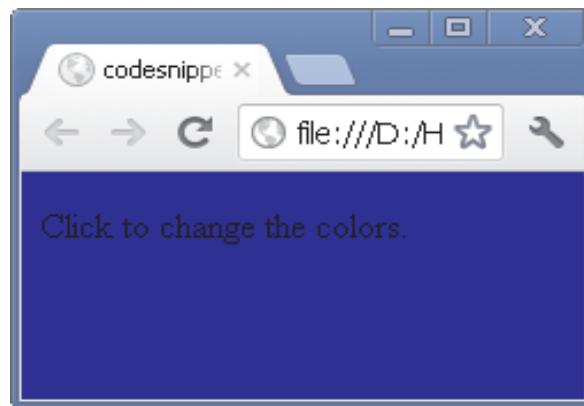


Figure 13.16: Toggle Effect to Blue

Click the text and it will change the background-color to pink.

Figure 13.17 displays the toggle effect to pink.



Figure 13.17: Toggle Effect to Pink

Click the text and it will change the background-color to grey.

Figure 13.18 displays the toggle effect to grey.

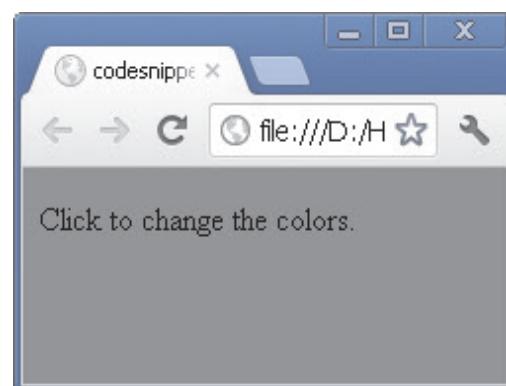


Figure 13.18: Toggle Effect to Grey

13.9 Inclusion of External Content in Web Pages

HTML5 introduces the `<eventsource>` tag that allows the user to push external content in the Web page. This model is referred to as push model. Since the `<eventsource>` tag is not supported in many browsers, users make use of the `<embed>` tag for this purpose. The `<embed>` tag is a new element in HTML5 and it is represented as a container for an interactive content or an external application. The `<embed>` tag is often used to add elements such as image, audio, or video on a Web page.

Code Snippet 16 demonstrates the use of the `<embed>` tag.

Code Snippet 16:

```
<embed src="mymovie.mp3" />
```

In the code, the `src` attribute specifies the path of an external file to embed.

13.10 Introduction to Web Storage

Consider an e-mail client, such as Gmail. To log in to your mail account in Gmail, you must enter your username and password.

Figure 13.19 shows the login screen of Gmail.

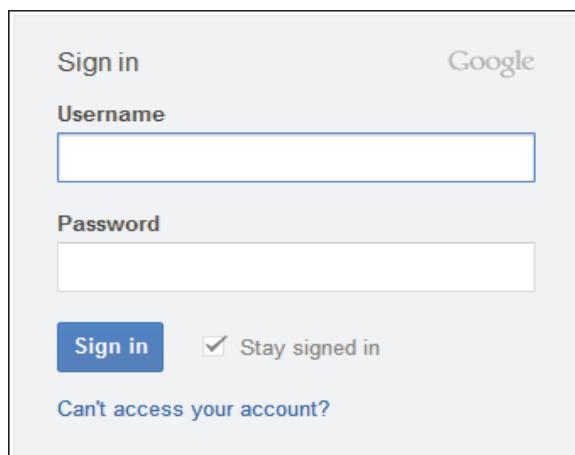


Figure 13.19: Login Screen of Gmail

As shown in Figure 13.19, the **Stay signed in** check box, specifies that the login details, such as Username and Password, should be remembered by the computer.

Traditionally, over the last few decades, Web applications have been using cookies to store small amounts of information on a user's computer. A cookie is a file that stores user-related information and may either be temporary or permanent. Thus, in this case, a cookie can be created for login details which can be saved for a specified period on a user's computer.

However, the drawbacks of cookies are as follows:

- Cookies slow down the performance of Web application, as they are included with each HTTP request.

- Cookies cannot be considered as safe means for transmission of sensitive data.
- Cookies cannot store large amount of information, as they have a limitation of size of 4 KB.

To overcome these drawbacks and offer a solution to store data on the client-side, W3C has designed a specification named Web Storage API.

The Web storage provides the functionality using which data can be stored on the client-side for a session or beyond the session.

13.11 Web Storage in HTML5

Web storage is a W3C specification. It provides functionality for storage of data on the client-side that is on user's machine. This data can cater for both temporary as well as permanent requirements. Certain browsers also refer to it as 'DOM Storage'. The advantage of such storage is that it offers more control than traditional cookies and is easy to work with.

Web storage was originally a part of the HTML5 specification, but now it is present in a separate specification. It enables to store a maximum of 5 MB of information per domain.

HTML5 Web applications make use of Web storage to implement client-side persistent storage.

13.11.1 Web Storage versus Cookies

There are some key differences between cookies and Web storage that are as follows:

- Cookies are meant to be read on the server-side, whereas Web storage is available only on the client-side. The server cannot read or write to it directly.
- Cookies are sent along with each HTTP request to the server, whereas Web storage data is not carried over to the server.
- Cookies can result in bandwidth overhead and thus lead to high costs, as they are sent with each HTTP request. The Web storage is stored on the user's hard drive, so it costs nothing to use.
- As mentioned earlier, with cookies, the information data that could be stored is 4 KB, whereas with Web storage, a large amount of data can be stored up to 5 MB.

13.11.2 Browser-specific Web Storage

Web storage is browser-specific. If a user visits a site in Google Chrome, any data will be stored to Google Chrome's Web storage store. Similarly, if the user revisits that same site in Firefox, the data saved earlier through Google Chrome will be unavailable. The location where the Web storage data is stored depends on the browser. Each browser's storage is separate and independent, even if it is present on the same machine.

HTML5 Web storage is implemented natively in most Web browsers, so one can use it even when a third-party browser plug-in is not available.

Table 13.2 lists the support of various browsers for HTML5 Web storage.

Browser	Version
IE	8.0+ Onwards
Firefox	3.6+ Onwards
Safari	4.0+ Onwards
Chrome	5.0+ Onwards
Opera	10.5+ Onwards

Table 13.2: HTML5 Web Storage Support

13.12 Exploring Web Storage

The two types of HTML5 Web storage are namely, session storage and local storage. Both session and local storage enable to store around 5 MB of data per domain. Before going into the details of these types, you must determine, if the current version of your browser has support for HTML5 Web storage.

To check for browser support of HTML5 Web storage, a property named `localStorage` or `sessionStorage` is available as a global variable for the `window` object. If there is no support, the `localStorage` or `sessionStorage` property will be `undefined`.

Code Snippet 17 demonstrates the script to check the support for HTML5 Web storage in the browser.

Code Snippet 17:

```
<!DOCTYPE html>
<html>
<head>
    <title>Support for Web Storage</title>
    <script>
        function checkSupport()
        {
            if ('sessionStorage' in window) && window['sessionStorage'] !== null)
            {
                alert("Your browser supports Web Storage");
                return;
            }
            alert("Your browser does not support Web Storage");
        }
    </script>
</head>
<body onload="checkSupport();">
</body>
</html>
```

Here, in the code, the `if` statement checks whether a property named `sessionStorage` exists in

the global `window` object. If the property exists, it means that session storage is supported and an appropriate message is displayed to indicate the same. If however, the property does not exist, it means session storage is not supported on that browser and an appropriate message is displayed to indicate the same.

Figure 13.20 shows the Web storage support.

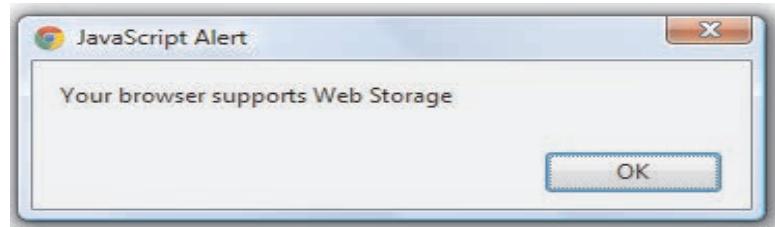


Figure 13.20: Web Storage Support

13.12.1 Session Storage

Session storage keeps track of data specific to one window or tab and discards it as soon as the user closes the tab (or window) that he/she was working with. Thus, even if you are visiting the same site in two different windows, each window will have its own individual session storage object. This means that each window contains separate session storage object with distinct data. Session storage lasts for the entire duration of the session and hence, is not persistent.

Session storage makes use of named key/value pairs. The data is stored using the named key, whereas the data is retrieved by referring to that key. Both the key-value pairs are enclosed within double quotes.

The key is a string, whereas the value stored in the key can be of any type of data, such as string, boolean, integer, or float. Regardless of the type of data that is stored, it is actually stored internally as a string.

Therefore, storing and retrieving data of other types requires the use of functions to convert them into the appropriate data types.

For example, the function, `parseInt()` is used to convert data into an appropriate JavaScript data type.

Table 13.3 lists some examples of named key/value pairs belonging to various data types.

Key	Value
Name	Sarah
book	C Programming
Email	info@me.com
car	Toyota Innova
age	28
uservalid	true

Table 13.3: Key/Value Pairs

There are several operations that can be performed with the `sessionStorage` object.

These operations are described as follows:

→ **Storing and retrieving data**

The `setItem()` and `getItem()` methods are used to store and retrieve data from session storage respectively.

The syntax to use the `setItem()` and `getItem()` methods is as follows:

Syntax:

- **To assign data**

```
sessionStorage.setItem(key, value);  
where,
```

`key`: Is the named key to refer to the data

`value`: Is the data to be stored

- **To retrieve data**

```
var item = sessionStorage.getItem(key);  
where,
```

`item`: Is the variable into which the data will be saved

`key`: Is the named key to refer to the data

Code Snippet 18 demonstrates how to set and retrieve a name using `sessionStorage` object.

Code Snippet 18:

```
<!DOCTYPE html>  
<html>  
<head>  
  <title>Working with Session Storage</title>  
  <script>  
    function testStorage() {  
      if ('sessionStorage' in window) && window['sessionStorage'] !== null)  
      {  
        sessionStorage.setItem('name', 'Sarah');  
        alert('The name is: ' + sessionStorage.getItem('name'));  
      }  
    }  
  </script>  
</head>  
<body onload="testStorage();">  
</body>  
</html>
```

The code stores the string literal 'Sarah' in the key, `name`. This is done using the `setItem()` method. Then, the string literal is retrieved and displayed as an alert using the `alert()` method on the browser page. To retrieve the string literal, the `getItem()` method has been used in the code.

Figure 13.21 shows the output for storing and retrieving name on the Web page using `sessionStorage` object.

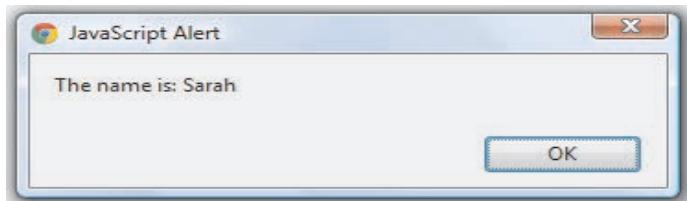


Figure 13.21: Output – Storing and Retrieving Using Session Storage

Note - Web Storage API is supported in Internet Explorer from version 9 onwards.

Key names may not necessarily be given as strings. Even, a number can be specified as a key name, though internally while storing, it will be converted to a string.

Code Snippet 19 shows the script that uses number as the key.

Code Snippet 19:

```
<script>
    function testStorage()
    {
        if ('sessionStorage' in window) && window['sessionStorage'] !== null)
        {
            sessionStorage.setItem(6, 'The book was wonderful');
            var feedback = sessionStorage.getItem(6);
            alert(feedback);
        }
    }
</script>
```

Here, in the code, the key is set to a numeric value `6`, but that does not mean that it is the sixth key. The name of the key is defined as `6` that is stored internally in the browser. The `getItem()` method is used to retrieve the value stored with that key. Finally, the value having the key as `6` is displayed in the alert window.

Figure 13.22 shows the output that retrieves value stored at the key, `6`.

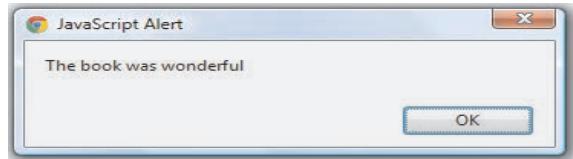


Figure 13.22: Output – Retrieves Value Stored at Key 6

Similar to other JavaScript objects, sessionStorage object can be treated as an associative array.

Instead of using the `getItem()` and `setItem()` methods, an array subscript can be used to retrieve and assign the data.

For example, `sessionStorage.setItem('name', 'John');` can be written as
`sessionStorage['name'] = 'John';`

Similarly, `alert(sessionStorage.getItem('name'));` can be written as
`alert(sessionStorage['name']);`

As mentioned earlier, it is also possible to store non-string values into session storage. Code Snippet 20 demonstrates the storage of an integer value for age and is later retrieved by using `parseInt()` method along with the `getItem()` method.

Code Snippet 20:

```
<!DOCTYPE html>
<html>
<head>
<meta charset="utf-8">
<title>Session Storage </title>
<script>
function store() {
    if ('sessionStorage' in window) && window['sessionStorage'] !== null) {
        var name = document.getElementById('name').value;
        sessionStorage.setItem('username', name);
        var data = sessionStorage.getItem('username');
        sessionStorage.setItem('age',
            document.getElementById('age').value);
        var agevalue = parseInt(sessionStorage.getItem('age'));
        alert(data + ' is ' + agevalue + ' years old');
    }
}
</script>
</head>
<body>
<form name="myform">
```

```
<label>Enter Name:</label>
<input type="text" id="name">
<br />
<label>Enter Age:</label>
<input type="text" id="age">
<br />
<input type="button" value="Submit" onclick="store()"/>
</form>
</body>
</html>
```

In the code, the `parseInt()` method converts the specified argument to an integer format.

Figure 13.23 shows the output for storing and retrieving the form data having integer values.

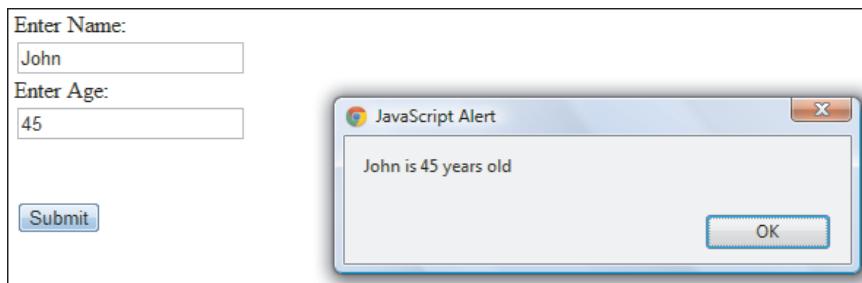


Figure 13.23: Output – Form Data Having Integer Values

→ **Removing and Clearing Data**

It is also possible to remove and clear data from the session storage. The `removeItem()` method is used to remove a particular item from the list.

The syntax for the `removeItem()` method is as follows:

Syntax:

```
sessionStorage.removeItem(key);
```

where,

key: Is the named key for the data

To remove the value associated with the key, `username` set in Code Snippet 20, the statement must be specified as follows:

```
sessionStorage.removeItem('username');
```

Similarly, in order to clear all items present in the session storage, use the `clear()` method as shown:

```
sessionStorage.clear();
```

Also, the `length` attribute determines the number of key/value pairs present in the storage.

```
var itemcount = sessionStorage.length;
```

13.13 Local Storage

Unlike session storage, local storage enables to save data for longer periods on the user's computer, through the browser. The data is persistent and can be retrieved when a user visits the site again. In other words, local storage is used, if data must be stored for more than a single session. A simple scenario would be to count the number of times a person has visited a Web page.

In terms of methods, local storage works in a similar fashion as session storage. It uses the same functions, such as `setItem()`, `getItem()`, `removeItem()`, and `clear()`.

Code Snippet 21 demonstrates the use of local storage to store the value of `username` field and later, retrieve the value in another Web page.

Code Snippet 21:

```
<!DOCTYPE html>
<head>
    <title>Local Storage</title>
    <script>
        function store()  {
            if ('localStorage' in window) && window['localStorage'] !== null)  {
                var username = document.getElementById('username').value;
                localStorage.setItem('username', username);
            }
            else
            {
                alert ('your browser does not support storage');
            }
        }

        function cancel_store()  {
            if ('localStorage' in window) && window['localStorage'] !== null)  {
                localStorage.removeItem('username');
            }
            else
            {
                alert ('your browser does not support storage');
            }
        }
    </script>
</head>
<body>
    <form method="get" action="success.html">
        Username: <input type="text" id="username" value="" size="20"
        onblur="store()"/>
    </form>
</body>
```

```
<input type="submit" value="Submit" />
<input type="reset" Value="Cancel" onclick="cancel_store()"/>
</body>
</html>
```

Here, in the code, the support of **localStorage** object is checked in the current browser. If it is supported, then the contents of the **username** box are retrieved and stored in a variable named **username**. Then, the content of this variable is assigned to the local storage object with the key set as **username**. If **localStorage** object is not supported, an appropriate message is displayed in the alert window.

Also, the function **cancel_store()** is invoked when the user clicks **Cancel**. In the **cancel_store()** function, the **removeItem()** method removes the specified key and its value from local storage.

When the **Submit** button is clicked, the user is redirected to the Web page, **success.html**, which displays the value stored with the key, **username**.

Code Snippet 22 shows the **success.html** page that retrieves value from the local storage and displays it in the browser.

Code Snippet 22:

```
<!DOCTYPE html>
<head>
<title>Local Storage</title>
<script>
function print()
{
    var username = localStorage.getItem('username') ;
    document.getElementById('lblMsg').innerHTML = 'Username: is <b>' +
        username+ '</b>' ;
}
</script>
</head>

<body onload="print()">
<label id="lblMsg"></label><br>
</body>
</html>
```

Here, in the code, **getItem()** method of local storage retrieves the value from the **username** key and stores in the variable **username**. Then, the value of the variable **username** is displayed in the **<label>** tag.

Figure 13.24 shows the output of the Web page with the user input, **John**.

Figure 13.24: Output – Web page with User Input

Figure 13.25 shows the output of `success.html` Web page that displays the value for `username` key stored in the local storage.

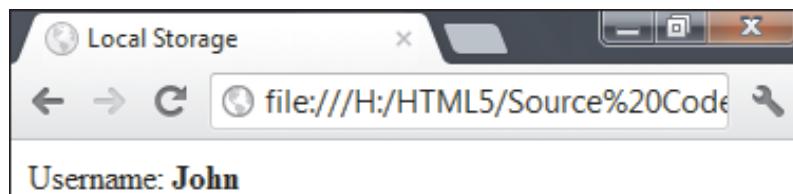


Figure 13.25: Output – Displaying Value from Local Storage

13.14 Indexed Database API

A database is an organized collection of data. Databases, such as relational database stores the data in the form of tables. A table comprises rows and columns that are used to store data. The representation of data from a table is in the form of records.

HTML5 has introduced a new Web Storage API which can host Web databases locally within the user browser. However, Web databases are not like relational databases in terms of functionality.

Indexed Database API is a specification also known as IndexedDB. It is basically an object store that can be used to store and manipulate data on the client-side. The object store is the primary storage mechanism that stores the object in the database managed locally within the browser. It enables to create an object store of a particular type in which objects can be persisted using JavaScript. Thus, IndexedDB enables to create Web applications with rich query abilities and which can work both online and offline.

IndexedDB supports two types of API namely, synchronous and asynchronous. The synchronous API can be used with WebWorkers, whereas asynchronous API can be used for Web applications. Currently, no major browsers provide the support for synchronous API.

The IndexedDB API is implemented using `window.indexedDB` object. As the current specification is still in the evolving stage, browsers implement the `IndexedDB` object with their own prefixes. For example, Chrome browser uses the `webkit` prefix, whereas Mozilla supports `-moz` prefix.

Table 13.4 lists the browser support for the IndexedDB API.

IE	Edge	Firefox	Chrome	Safari	Opera	iOS Safari
-	-	10.0	23	-	-	
10.0	79-90	16-89	24-90	10-14	15-76	10-14.4
11.0	91	90	91	-	77	-
		91-92	92-94	15	-	14.7

Table 13.4: Browser Support for IndexedDB API

13.14.1 IndexedDB API

Some of the basic constructs of IndexedDB API are as follows:

- **Database** - The IndexedDB database comprises more than one object store. Each database contains a name that identifies the origin of the database and a version number which identifies the lifetime of the database.
- **Object Store** - Object store is the main mechanism to store data in a database. They hold the data stored in the database in the form of records.
- **Keys** - Each record stored in the database is identified by a unique key.
- **Values** - Values are the data stored in the records.
- **Key Path** - A key path is a string that defines how the browser should extract key from a value. The key from a value can be extracted either in the object store or index. An empty string, a JavaScript identifier, and so on is some of the valid key paths.
- **Index** - It is used when the data from the object store is retrieved based on some other values other than a key. It is a specialized object store which searches for records in another object store known as referenced object store.
- **Transaction** - Any addition or retrieval of the data in a database is performed by using transaction. In other words, it is a mechanism used for interacting with the database. Each transaction has a mode, scope, and a request list. The mode determines the type of transaction that can be performed, scope identifies the object store on which the transaction will be performed, and finally request list determines the requests that have been made.
- **Requests** - Operations, such as reading or writing on the database is performed using a request. Each request contains attributes, such as flag, source object, result, and error.
- **Cursor** - Cursor is a mechanism used to retrieve multiple records from a database.
- **Key Range** - Records from the object stores and indexes are retrieved using keys or key ranges. A key range refers to retrieval of data between specified bounds based on the keys.

13.14.2 Implementing IndexedDB API

The steps to implement the IndexedDB API in a Web application are as follows:

1. Open a database
2. Create an object store
3. Start a transaction
4. Perform some database operations, such as add and retrieve
5. Work with the retrieved results

→ Opening a Database

Code Snippet 23 shows the code to open a database.

Code Snippet 23:

```
var indexedDB = window.indexedDB || window.webkitIndexedDB || window.mozIndexedDB || window.msIndexedDB;
var request = indexedDB.open("CompanyDB", 1);
request.onsuccess = function (event) {
    ...
};
request.onerror = function (event) {
    console.log("IndexedDB error: " + event.target.errorCode);
};
```

Here, the code detects the support for IndexedDB API in different browsers and creates the indexedDB object. The indexedDB object contains a method named `open()` which opens the CompanyDB database.

In case, if the database exists, then `open()` method simply opens it, otherwise creates the database.

The `open()` method returns an IDBRequest object named `request`. The `request` object provides handlers, such as `success` and `error`. These handlers are invoked depending on the success or failure of opening the database. The `onsuccess()` handler contains an event of type `success` as its argument. Similarly, `onerror()` handler is invoked with an `error` event as its argument.

→ **Updating Version of a Database**

After the database is opened, it can be structured by providing a version number. This helps to set up the database.

The version number will be specified to a database in the `onsuccess()` function.

Code Snippet 24 shows the code that specifies the version number to the database `CompanyDB`.

Code Snippet 24:

```
var setVrequest = db.setVersion("1.99");
setVrequest.onsuccess = function(event) {
    ...
}
```

→ **Creating the Object Store**

The structure of IndexedDB database facilitates the storage of multiple object stores. In other words, there can be more than one object stores in the database. Object store is created using `createObjectStore()` method. The `createObjectStore()` methods accepts two arguments namely, the store name and a parameter object. The parameter object is used for defining an optional property which is important. In this case, a key path is defined that is used for identifying unique objects in the object store. For example, an employee store contains the `id` property as key

path, which will be unique for each object and must be present for each object.

Code Snippet 25 demonstrates the code to create an object store named `employee` in the `CompanyDB` database.

Code Snippet 25:

```
var employeeData = [
    { name: "John Smith", email: "john@company.com" },
    { name: "Jill Patrick", email: "jill@company.com" },
    { name: "Rock Ethan", email: "rock@company.com" },
    { name: "Daniel Andrew", email: "daniel@company.com" }
];
var objectStore = db.createObjectStore("employee", {
    keyPath: "id", autoIncrement: true });
for (i in employeeData) {
    objectStore.put(employeeData[i]);
    alert("Record added");
}
```

The code creates an array named `employeeData` containing name and e-mail values. Then, the `createObjectStore()` method creates an `employee` store with its key path set to `id` attribute. The key path is used with `autoIncrement` option that automatically generates `id` for each of the objects. All individual objects in the object store are identified based on the `id`. Finally, the `for..in` loop stores the data in the `employee` object store.

→ **Creating a Transaction**

To perform database operation, such as retrieving data from the object store, IndexedDB provides a `IDBTransaction` object. This object can be created in three mode namely, read-only, read-write, and snapshot. The read-write mode is used to update the object, whereas read-only mode is used for other operations.

Code Snippet 26 demonstrates the code to retrieve data from the `employee` object store using the `get()` function of the `transaction` object.

Code Snippet 26:

```
var trans = db.transaction(["employee"], IDBTransaction.READ_WRITE);
objectStore("employee");
    var request = trans.get(2);
    request.onerror = function(event) {
        // Handle errors!
    };
    request.onsuccess = function(event) {
```

```
// Do something with the request.result!
alert("Name: " + request.result.name);
};
```

In the code, the `transaction()` method accepts two parameters. The second parameter is optional. The first parameter is the list of the object stores that are extended by the `transaction` object. In this case, there is a single object store named `employee`, created in the database. The optional second parameter specifies the type of the transaction, that is, `read-only`, `read-write`, or `snapshot`. Here, the transaction type is defined as `IDBTransaction.READ_WRITE`. This type allows reading as well as writing in the database. The `employee` object store is retrieved from the `transaction` object on which operations are performed. Here, the `get()` method is invoked on the `employee` object store which returns the value against the key path 2. Finally, the result of the `get()` method is stored in the `request` object on which callback functions, such as `onsuccess` and `onerror` are invoked.

→ **Opening a Cursor**

Cursor is used to retrieve multiple records from an object store. They can be used when the value of key path is not known. They are part of a transaction and are opened for a particular object store.

Code Snippet 27 demonstrates the code to retrieve multiple records from the `employee` object store.

Code Snippet 27:

```
store=db.transaction("employee").objectStore("employee");
store.openCursor().onsuccess=function(event) {
  var cursor = event.target.result;
  if (cursor) {
    alert("Name for id " + cursor.key + " is " + cursor.value.name);
    cursor.continue();
  }
};
```

Here, in the code, the `transaction` object is created for the `employee` object store. Then, the `openCursor()` function is invoked on the object store. If the cursor is successfully opened, a `cursor` object is returned which will retrieve the data from the object store.

Code Snippet 28 shows the complete code for opening, creating, and retrieving data from the object store using the IndexedDB API.

Code Snippet 28:

```
<!DOCTYPE html>
<html>
  <head>
    <title>IndexedDB API</title>
  <script>
```

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```
// Detect the support for IndexedDB API
var indexedDB = window.indexedDB || window.webkitIndexedDB || window.
    mozIndexedDB || window.msIndexedDB;
var IDBTransaction = window.IDBTransaction || window.
    webkitIDBTransaction;

var db;
var transaction;
var store;
var objectStore;
var employeeData = [
    { name: "John Smith", email: "john@company.com" },
    { name: "Jill Patrick", email: "jill@company.com" },
    { name: "Rock Ethan", email: "rock@company.com" },
    { name: "Daniel Andrew", email: "daniel@company.com" }
];
function initDb() {
    var request = indexedDB.open("CompanyDB", 1);
    request.onsuccess = function (evt) {
        db = request.result;
        var setVrequest = db.setVersion("1.99");
        setVrequest.onsuccess = function (e) {
            if (db.objectStoreNames.contains("employee")) {
                db.deleteObjectStore("employee");
                alert ('Existing Employee Object Deleted');
            }
            objectStore = db.createObjectStore("employee", {
                keyPath: "id", autoIncrement: true });
            alert ('Employee Object Created');
            objectStore.createIndex("name", "name", { unique:
                false });
            objectStore.createIndex("email", "email", { unique:
                true });
            for (i in employeeData) {
                objectStore.put(employeeData[i]);
                alert ("Record added");
            }
        };
    };
    request.onerror = function (evt) {
```

```
        console.log("IndexedDB error: " + evt.target.errorCode);
    };
}

function employee_details() {
    store = db.transaction("employee").objectStore("employee");
    store.openCursor().onsuccess = function(event) {
        var cursor = event.target.result;
        if (cursor) {
            alert("Name for id " + cursor.key + " is " + cursor.value.name);
            cursor.continue();
        }
    };
}

function search_employee() {
    trans = db.transaction(["employee"], IDBTransaction.READ_WRITE)
        .objectStore("employee");
    var request = trans.get(2);
    request.onerror = function(event) { // Handle errors! };
    request.onsuccess = function(event) {
        // Work with the request.result
        alert("Name: " + request.result.name);
    };
}

window.addEventListener("DOMContentLoaded", initDb, false);
</script>
</head>
<body>
<input type="button" value="Print Employees Details" onclick="employee_details()" /><br/>
<input type="button" value="Search Employee Based on Key" onclick="search_employee()" />
</body>
</html>
```

The program execution starts with the creation of `employee` object store in which records are added.

The alert window displays the message, 'Record added' while storing the records in the object store. Then, the application allows the user to query the database by clicking the **Print Employee Details** and **Search Employee Based on Key** buttons.

Figure 13.26 shows the output for the `employee` object store in the Chrome browser, when a user

clicks **Search Employee Based on Key** button.

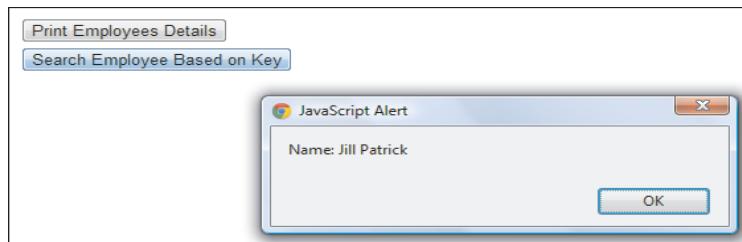


Figure 13.26: Output – Retrieve Employee Object Based on Key

13.14.3 Limitations of IndexedDB API

The IndexedDB API is used for client-side storage of data, but it has some design limitations. These limitations are as follows:

- Internationalized sorting deals with sorting of string data. As the database does not follow any international order for storing data, internationalized sorting is not supported by the API.
- The IndexedDB API does not synchronize client-side database with the server-side databases. If required, then a code must be written to perform server-side synchronization.
- The IndexedDB API supports querying the client-side database, but does not support the use of operators, such as `LIKE` that is used by Structured Query Language (SQL). SQL is a query language used by server-side databases to perform operation in the database.

13.15 Converting HTML5 Apps to Native Apps

A native application is also known as native app. It is an application program that is built to be used on a particular device or platform. A native app, when compared with Web app, is installed on a device and has a faster response, because it has a direct user interface. Figure 13.27 displays different platforms that support native apps.



Figure 13.27: Different Platforms Supporting Native Apps

For example, FaceTime is a native app available on iOS mobile devices.

13.15.1 Differences Between Native Apps and HTML5 Apps

With HTML5 release, a discussion started about HTML5 which involved whether HTML5 can develop native mobile apps (that is apps designed especially for iPhone, Android, and so on).

HTML5 is the latest version of HTML language providing a simple building block for Web pages. This is the first version of markup language that supports the use of multimedia without using any additional plug-in and is supported by many devices and computer systems.

HTML5 Web apps are accessible and used on any devices through Web browser similar to the mobile Website. The Web apps have the ability of offline access which means that the user does not require to have a network connection.

Table 13.5 lists differences between the native apps and HTML5 apps.

Native Apps	HTML5 Apps
Native Apps runs on iOS and Android devices that can be downloaded or purchased from online app stores.	HTML5 Apps runs on a Web server, usually in a Web browser.
Native Apps use programming language, such as Java for Android devices and Objective C for iOS devices.	Web developers use HTML, JavaScript, and CSS. They must acquire skills of Java and objective C for writing native applications.

Table 13.5: Difference Between Native Apps and HTML5 Apps

13.15.2 Advantages of HTML5 Apps

The main advantage of using HTML5 is to create applications that execute on a wide range of devices easily. App development on HTML5 is cheaper as compared to native app development. Developers do not have to learn any new programming language and the development becomes much easier.

There are many reasons to develop HTML5 applications rather than native applications. Some of the reasons are as follows:

→ **Users cannot identify the differences**

There are many instances where the users cannot identify whether they are working on a hybrid HTML5-native application or a fully native application or an HTML5 application.

→ **Users adjust styles for devices**

HTML5 apps can be viewed on any devices that contains Web browser. Users can also use CSS3 for applying styles to change the look according to their requirements. HTML5 apps look similar to Web pages by using the same code.

→ **Upcoming functionalities**

HTML5 does not support all features on a device, but it is coming up with new functionalities.

There are several APIs that exist for working on local databases, Web storage, drag-and-drop, offline Web pages, and many more. New APIs are being planned in future to provide Web pages access to the software and hardware of a device.

→ **Improving performance**

Many developers learn new methods to improve the performance of Web pages. These same methods are useful to mobile HTML5 apps. There are many apps, such as timer, mail, databases, and news apps that do not require to be faster.

→ **Independent device**

HTML5 apps work on mobile devices as well as Web browsers, as it is important for development purpose. There are millions of laptop and desktop users than mobile users. If the developers want that their application to be used by a large number of users, then they should design and develop the application for both mobile users as well as desktop users.

→ **Developers are not locked in app stores**

There are a number of app stores existing for Android. If developers wish to sell apps, then they are required to upload them into as many stores or marketplaces as possible.

Using HTML5, developers are not restricted to an app store. Instead, they can create applications and sell them like any other Web application.

HTML5 app acts a substitute to native apps, though in several conditions, native apps can be used for better purpose. Developers can create hybrid applications that are a combination of native and HTML apps.

13.15.3 Advantages of Native Apps

Major advantage of native apps over HTML5 apps is that they are faster than HTML5 apps. Similar to normal Web pages, HTML5 apps are slow, because these apps work on HTTP that uses a request/response cycle mechanism. When an HTTP request is made, it takes more time for the applications to execute as it has to wait for the request to go and return back with a response.

Native apps provide many more benefits over HTML5 apps. These benefits are as follows:

→ **Providing access to device hardware**

Many mobile devices contain hardware, such as accelerometer, GPS, a camera, and so on. The GPS is accessible through Geolocation API. At present, there are no APIs available for accelerometers, cameras, or any other device hardware for HTML5 apps.

→ **Uploading Files**

Native apps can access the file system in Android and some files in iOS. However, the HTML5 file API does not work on Android or iOS.

→ **Push Notifications**

The push notifications are sent always with an open Internet Protocol (IP) connection to applications on the iOS device. Android also has a same feature named Cloud to Device Messaging.

→ **Accessing device files**

Native apps communicate with files on devices, such as contacts and photos. However, these files cannot be seen from HTML5 apps.

→ **Superior graphics than HTML5**

HTML5 has a <canvas> element, but it will not be able to create a full 3D experience.

→ **Offline access**

HTML5 provides access to offline Web applications. However, a native app is stored on local machine, so the users do not require access to the Web to work with the application.

→ **In-app purchasing and advertising**

HTML5 apps allow developing in-app stores and advertising. Native apps have these features pre-built in them through app stores. Selling the apps in app store is easy, as HTML5 apps are Web pages that are difficult to sell.

Native apps have an additional benefit, that is trust. Several users are comfortable using application downloaded from app stores than using a Web page. These app stores are preferred than search engines, by the users for finding tools.

13.15.4 Converting HTML5 Apps to Native Apps

Users have a choice of developing their application in HTML5 and then, converting them into a native app. This choice has many combined benefits of HTML5 apps and native apps. Users can use tools to convert HTML5 app to a native app.

Following are the best tools used for generating native apps:

→ **Apache Cordova**

Apache Cordova (formerly PhoneGap) is a software that allows the user to create native apps with Web technologies and is accessible to app stores and APIs. Through this software, developers can build applications for mobile devices using CSS3, HTML5, and JavaScript, instead of relying on platform-specific APIs such as those in Android, iOS, or Windows Phone.

→ **Appcelerator**

Appcelerator is a cross-platform mobile application development support. It allows the users to create Android, iOS, and mobile Web apps. Native applications are developed using a JavaScript code base with Eclipse as the IDE.

13.16 Check Your Progress

1. The _____ element used in HTML5 is not only limited to draw rectangles on the Websites, but also allows the user to draw graphics using JavaScript.

(A)	Canvas	(C)	Rectangle
(B)	Line	(D)	Arc

2. The _____ property can be a gradient, pattern, or a CSS color.

(A)	fillText	(C)	strokeStyle
(B)	strokeText	(D)	fillStyle

3. Which of the following methods is used to draw a circle in HTML5 canvas?

(A)	line()	(C)	arc()
(B)	stroke()	(D)	rect()

4. Which of the following events respond to mouse clicks?

(A)	hover()	(C)	toggle()
(B)	pressed()	(D)	changed()

5. Which of the following methods are used to draw an image object on canvas?

(A)	drawImage()	(C)	hover()
(B)	draw()	(D)	onload()

6. Identify the methods that are used to store and retrieve the data from session storage.

(A)	setItem()	(C)	retreiveItem()
(B)	getItem()	(D)	displayItem()

7. _____ runs on iOS and Android devices that can be downloaded or purchased from the online app stores.

(A)	Native apps	(C)	Web browser
(B)	Web apps	(D)	Web Server

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8. _____ is a mechanism to store data in a database in the IndexedDB API.

(A)	Object store	(C)	Cursor
(B)	Index	(D)	Database

9. Which of the following is the correct code to check the support for session storage in the browser?

(A)	<pre>function checkSupport() { if ((sessionStorage in window) && window[!sessionStorage] !== null) { alert("Your browser supports Web Storage"); return; } }</pre>
(B)	<pre>function checkSupport() { if ('sessionStorage' in window) { alert("Your browser supports Web Storage"); return; } }</pre>
(C)	<pre>function checkSupport() { if ('sessionStorage' in window) window['sessionStorage'] !== null) { alert("Your browser supports Web Storage"); return; } }</pre>
(D)	<pre>function checkSupport() { if ('sessionStorage' in window) && window['sessionStorage'] !== null) { alert("Your browser supports Web Storage"); return; } }</pre>

13.16.1 Answers

1.	A
2.	D
3.	B
4.	C
5.	A
6.	A, B
7.	A
8.	A
9.	D

Summary

- The <canvas> element is a drawing area where the user can draw graphics, use images, add animations, and also add text for enhancing the user experience on Web pages.
- To create a line, on a canvas one can use the stroke(), beginPath(), lineTo(), and moveTo() methods.
- Arcs are represented using a start angle, an end angle, a radius, a center point, and the drawing direction (anticlockwise or clockwise).
- With HTML5 canvas, the user can create a rectangle using the rect() method.
- Bezier curves are represented with the two control points, context points, and an end point.
- HTML5 canvas allows the user to create quadratic curves using the quadraticCurveTo() method.
- HTML5 canvas enables the user to draw image object on canvas using the drawImage() method.
- Web Storage is a W3C specification that provides functionality for storing data on the client-side for both temporary as well as permanent requirements.
- HTML5 Web applications make use of Web storage to implement client-side persistent storage and they are: session storage and local storage.
- Session storage keeps track of data specific to one window or tab.
- The setItem() and getItem() methods are used to store and retrieve the data from session storage.
- Local storage enables to save data for longer periods on the user's computer, through the browser.
- IndexedDB API is basically an object store that can be used to store and manipulate data on the client-side.
- A native application also called as native app is an application program that is built for a particular device or platform.

Try It Yourself

1. Jack is developing a Website for his company named Decant Technologies, headquartered at Germany. The company Website was developed on HTML 4. Now, they have decided to upgrade the Website using HTML5. The Website deals with different types of software products such as educational, applications, games, computer accessories, anti-virus, and many more. Recently, the company has launched some new software for kid's education and Jack has to add some shapes, images, and text to the new Web pages. Jack has decided to use the canvas element. Help him to develop the application.
2. Robin is creating a Website for his company named Maxim Technologies, headquartered at California. He wants to create an HTML5 Website for his company. The company Website deals with different types of mobile products such as laptops, smartphones, ipads, tablets, and notebooks. Robin wants to develop their company Website home page and add the details about the company. He also wants to add different types of images, text, videos, and arrange the content in an organized manner. He has decided to use canvas for the home page. Help him to develop the application.
3. Develop an HTML5 registration Web form with buttons, such as Add, Clear, Display, and Submit. When the user clicks Add, the data entered in the form should be persisted. When the user clicks clear, all the data stored on that page should be deleted. If user clicks Display, the page should print all the data stored in that session. Similarly, on clicking Submit, the next Web page will be displayed with the confirmation details of the user.
4. Modify the **CompanyDB** database application designed earlier in this session. Add the functionality to delete the records from the **employee** object store. Also, design a form to accept the employee details and add those details to the **employee** object store.



Session - 14

HTML5 Geolocation and APIs

Welcome to the Session, **HTML5 Geolocation and APIs**.

This session explains about the new APIs supported by HTML5. The session begins with the Geolocation API and Google Maps API used to determine and display the location on a map. Also, it explains the Drag and Drop mechanism which is used to perform the drag-and-drop operations. Finally, the session concludes with a description of Application Cache.

In this Session, you will learn to:

- ➔ Explain geolocation and its use in HTML5
- ➔ Explain the Google Maps API
- ➔ Explain the drag-and-drop operations in HTML5
- ➔ Explain the concept of Application Cache

14.1 Introduction

Consider a scenario where you are visiting a new city and are unaware of specific locations and routes. You want to get information regarding hotels in your locality, such as their exact address, tariffs, and so on. In such a situation, an application which can provide relevant information about the hotels based on your current location would be useful.

A feature that can detect location and list relevant information based on that location is called Geolocation. Geolocation is a term used to identify the geographic location of a person, place, or an object.

Today, modern devices, such as computers, smartphones, tablets, and so on provide Internet-enabled browsers through which the geographic locations of a user or an object can be detected.

14.2 Geolocation

Geolocation in computing terminology indicates a feature that determines the current location of a user on devices. The location of the user is represented as a single point that comprises two components: latitude and longitude. The components can be used further to retrieve more information for the user, such as businesses in the neighborhood or other users within the same coverage area.

Figure 14.1 shows the representation of latitude and longitude with respect to a location on the globe.

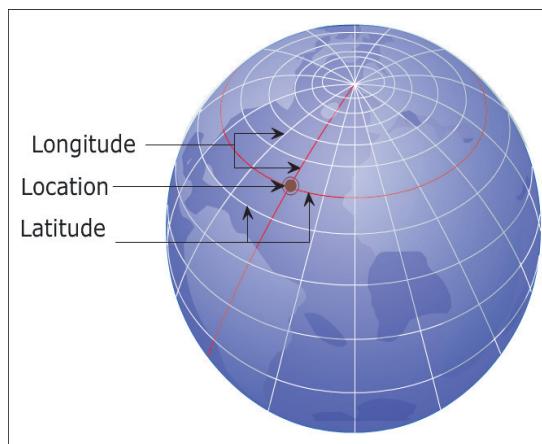


Figure 14.1: Latitude and Longitude

There are different sources through which devices can determine the information about the location. These are as follows:

- ➔ **GPS** - GPS is a satellite navigation system that provides information about the location on any part of the globe. The GPS system is maintained by the government of the United States and is used by modern mobile devices with GPS capability.
- ➔ **IP Address** - Location information can be derived from IP Address. The IP Address is assigned to devices, such as desktops, printers, and so on connected on a network.
- ➔ **GSM/CDMA Cell IDs** - These are used by cell phones.
- ➔ **WiFi and Bluetooth MAC address** - These are used by devices that have wireless network connection.

- **User Input** - It is a software tool which can be used on any device requesting for location information. The information retrieved by the tool is based on the data provided by the user, such as, a zip code.

14.3 Geolocation API

In HTML5, the Geolocation API is a specification provided by W3C. It provides a consistent way to develop location-aware Web applications.

The Geolocation API provides a high-level interface that can be used by developers to retrieve location information related to the hosting devices. The interface hides the details, such as how the information is gathered or which methods were used to retrieve the information. This helps the developer to concentrate on geographic information rather than its processing methods.

The object that holds implementation of the Geolocation API is the Geolocation object. This object is used in JavaScript to retrieve the geographic information about the devices programmatically. The browser processes the script and returns the location to the Geolocation API.

The Geolocation API is supported on most of the modern browsers available on desktop and mobile phones.

Table 14.1 lists the browsers providing support for Geolocation API.

Browser	Version Support
Safari	5.0+
Chrome	5.0+
Firefox	3.5+
Internet Explorer	9.0+
Opera	10.6+
iOS (Mobile Safari)	3.2+
Android	2.0+

Table 14.1: Browsers Supporting Geolocation API

Note - It is not necessary that information retrieved by the Geolocation API is the actual location of the device. For example, if the satellites are invisible to GPS, then it may not return accurate location information.

14.3.1 Implementing Geolocation Object

The Geolocation object is available as a new property of the `navigator` object. The `navigator` object is a browser object that allows a user to retrieve information about the specific location.

The syntax shows how to create a Geolocation object in JavaScript.

Syntax:

```
var geolocation = window.navigator.geolocation;
```

where,

window: Is the top level object in JavaScript object hierarchy

Code Snippet 1 demonstrates the script that tests the existence of Geolocation object within a browser.

Code Snippet 1:

```
<!DOCTYPE html>
<html>
<head>
<title>Testing Support for Geolocation in Browsers</title>
<script>
function display_location_enabled()
{
    // Default message
    var str = "Geolocation is not supported in this browser";
    if (window.navigator.geolocation)
    {
        str = "Geolocation is supported in this browser";
    }
    alert(str);
}
</script>
</head>
<body>
    <input type="button" value="Geolocation Support"
onClick="display_location_enabled()"></input>
</body>
</html>
```

In the code, the `if` statement checks existence of the `geolocation` property in the browser. If the browser provides an implementation for the property, then an alert window displays the message 'Geolocation is supported in this browser'. Otherwise, the default message is displayed.

Figure 14.2 shows the existence of Geolocation object in the Chrome browser.

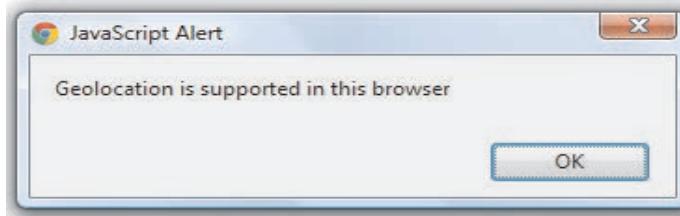


Figure 14.2: Output – Geolocation Object in Chrome Browser

14.3.2 Geolocation Methods

The Geolocation object provides three methods that can be used to determine the current position of the user.

Table 14.2 lists the methods of the Geolocation object.

Method	Description
getCurrentPosition()	Retrieves the current geographic location information of the user
watchPosition()	Retrieves geographic information of the device at regular intervals
clearWatch()	Terminates the current watch process

Table 14.2: Methods of Geolocation Object

Also, any changes in the user position is notified through the methods.

14.3.3 Retrieve User Position

The current position of a user is retrieved using the `getCurrentPosition (successCallback, errorCallback, options)` method. This function accepts three parameters, out of which two are optional, `errorCallback` and `options`.

The first parameter, `successCallback` is the name of the function which is invoked after the position of a device is found successfully. The second parameter, `errorCallback` is the name of the function which will be called, if an error occurs in retrieving the position. The last parameter, `options` represents a `PositionOptions` object.

Code Snippet 2 demonstrates the markup that will retrieve the current location of the user.

Code Snippet 2:

```
<!DOCTYPE html>
<html >
<head>
<title>Geolocation API</title>
<script>
function getLocation()
{
    if (navigator.geolocation) {
        navigator.geolocation.getCurrentPosition(showPosition);
    }
    else{
        alert ("Geolocation is not supported in this browser.");
    }
}
function showPosition(position) {
```

```
        alert('Latitude: ' + position.coords.latitude + '\n' + 'Longitude:  
              ' + position.coords.longitude);  
    }  
</script>  
</head>  
<body>  
    <input type="button" value="Display Location" onClick="getLocation()"/>  
</body>  
</html>
```

In the code, the `getCurrentPosition()` function obtains the position which is passed as a parameter to the `showPosition()` function. The `showPosition()` function obtains the coordinates of a location through `position` object.

The `position` object is defined in the Geolocation API and holds the current location of the device. It contains attribute named `coords` that retrieves the latitude and longitude of the location. The values retrieved for latitude and longitude are in decimal degrees.

Table 14.3 lists the attributes of the `position` object.

Attribute	Description
<code>coords</code>	An object of type <code>Coordinates</code> that provides different properties, such as latitude, longitude, altitude, accuracy, speed, and so on
<code>timestamp</code>	An object of type <code>DOMTimeStamp</code>

Table 14.3: Attributes of the `position` Object

Figure 14.3 shows the notifications for the Web page containing geolocation code. The browser seeks permission from the user to share their location information with the application.

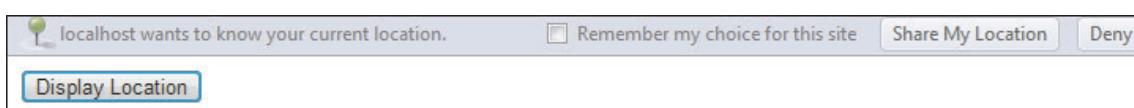


Figure 14.3: User Permission to Access Geolocation Application

Figure 14.4 shows a message displaying current location of the user, when the **Share My Location** button is clicked.



Figure 14.4: Output - Message Displayed in Opera

Note - The geolocation code works best on the latest Opera browser.

14.3.4 Handling Errors

An application could fail in gathering geographic location information. In that case, the Geolocation object calls an `errorCallback()` function. The `errorCallback()` function handles errors by obtaining a `PositionError` object from the API.

→ PositionError Object

The `PositionError` object holds information related to errors occurred while finding the geographic location of the user.

Table 14.4 lists the properties of `PositionError` object.

Property	Description
code	Returns a numeric value for the type of error occurred
message	Returns a detailed message describing the error encountered. The message can be used for debugging

Table 14.4: Properties of the `PositionError` Object

Table 14.5 lists different error codes returned by `code` property of the `PositionError` object.

Code	Constant	Description
1	PERMISSION_DENIED	Application does not have permission to access Geolocation API
2	POSITION_UNAVAILABLE	Position of the device could not be obtained
3	TIMEOUT	Unable to retrieve location information within the specified interval

Table 14.5: Error Codes

Code Snippet 3 demonstrates the error handling routine for the geolocation code.

Code Snippet 3:

```
<!DOCTYPE html>
<html>
<head>
    <title>Handling Error</title>
    <script>
        function getLocation() {
            function showPosition(position) {
                alert('Latitude: ' + position.coords.latitude + '\n' +
                    'Longitude: ' + position.coords.longitude);
            }
            function errorHandler(error) {
                switch (error.code) {
```

```
case error.PERMISSION_DENIED:  
    alert ('You have denied access to your position. ' );  
    break;  
case error.POSITION_UNAVAILABLE:  
    alert ('There was a problem getting your position. ' );  
    break;  
case error.TIMEOUT:  
    alert ( 'The application has timed out attempting to  
            get your position. ' );  
    break;  
}  
}  
</script>  
</head>  
<body>  
    <input type="button" value="Display Location" onClick="getLocation()"/>  
</body>  
</html>
```

In the code, if the application fails to find the current location of the user, then the `errorHandler()` function is invoked. The function is passed as the second parameter in the `getCurrentPosition()` method and is used to handle the errors occurred in the application. It obtains the `error` object which is of type `PositionError` from the API and compares it with the error codes specified in the switch-case statement. Depending on the error that has occurred, the appropriate case statement is executed and an alert message is displayed to the user.

Figure 14.5 shows the output displaying error message for geolocation application. The reason for displaying error is that the Chrome browser blocks the URL whose file path starts with `file:///`.



Figure 14.5: Output – Error Message in Chrome

14.3.5 PositionOptions Object

`PositionOptions` object is an optional third parameter passed to the `getCurrentPosition()` method. This object defines properties that are optional and are used by an application while retrieving the geolocation information.

Table 14.6 lists the attributes of `PositionOptions` object.

Attribute	Description
<code>enableHighAccuracy</code>	Indicates that the application wants to receive the most accurate results for geolocation. The default value of the attribute is false
<code>maximumAge</code>	Obtains the cached position object whose age is less than the specified maximumAge limit (in milliseconds). If age limit is set to 0, then the application must obtain a new position object
<code>timeout</code>	Indicates the maximum time length (in milliseconds) for which the application can wait to obtain the position object

Table 14.6: Attributes of the `PositionOptions` Object

Code Snippet 4 demonstrates the script to set the attributes of `PositionOptions` object. This code can replace relevant code in Code Snippet 3 to produce output.

Code Snippet 4:

```
<script>
    ...
    var options = {
        enableHighAccuracy: true,
        maximumAge: 50000,
        timeout: 60000
    };
    function getLocation() {
        if (navigator.geolocation) {
            navigator.geolocation.getCurrentPosition(showPosition,
                errorHandler, options);
        }
        else{
            alert ("Geolocation is not supported in this browser.");
        }
    }
    ...
</script>
```

In the code, an object named `options` is set with attributes. The attribute `maximumAge` enables the application to use a cached position object which is not older than 50 seconds. Also, the `timeout` limit is set to 60 seconds for an application, before notifying an error.

The `options` is passed as third parameter to the `getCurrentPosition()` method.

14.4 Google Maps API

The Google Maps API is used to display locations on a map based on the values of their coordinates - latitude and longitude. The Google Maps API must be configured in JavaScript, before it can be referenced further on the page. It contains a `Map` object which is instantiated and displayed on a Web page.

The syntax shows the configuration of Google Maps API in JavaScript.

Syntax:

```
<script src="http://maps.google.com/maps/api/js?sensor=false">
</script>
```

where,

src: Is the URL of Google Maps API

sensor: Parameter sent with the URL. It indicates whether application uses any sensor, such as GPS system to obtain the location of a user. Its value must be explicitly set to `true` or `false`

Code Snippet 5 demonstrates how to load and initialize the Google Maps API in the `<script>` tag. The code will execute after the page is loaded completely and will invoke a function in response to the `onload` event.

Code Snippet 5:

```
<!DOCTYPE html>
<html>
<head>
<title>Load and Initialize Google Maps </title>
<style>
    html { height: 100% }
    body { height: 100%; width: 100%; margin: 10% }
    #map_canvas { height: 50%; width: 50% }
</style>
<script src="http://maps.google.com/maps/api/js?sensor=false"></script>
<script>
function initialize() {
    // Loading Google Maps
    var num = new google.maps.LatLng(51.528663, -0.173171);
    var myOptions = {
        zoom: 16,
        center: num,
        mapTypeId: google.maps.MapTypeId.HYBRID
    };
    var mymap = new google.maps.Map(document.getElementById("map_canvas"),
        myOptions);
    var marker = new google.maps.Marker({
        position: num,
        map: mymap,
```

```
        title: "Lord's Cricket Ground, London!"  
    } );  
}  
</script>  
</head>  
<body onload="initialize()">  
    <div id="map_canvas"></div>  
</body>  
</html>
```

In the code, the URL "`http://maps.google.com/maps/api/js?sensor=false`" defines all symbols and definitions to be loaded for the Google Maps API. Then, the function `initialize()` is invoked after the page is loaded completely. This function creates the object of type `Map` and initializes it with the map initialization variables.

In the function, `var myOptions = {}`, is an object of type `options` that contains properties, such as `zoom`, `center`, and `mapTypeId`. These properties are used to initialize the map.

Then, the statement `new google.maps.Map (document.getElementById("map_canvas"), myOptions);` creates an instance of `Map` object. The object is displayed in a container on the Web page specified with the `<div>` element.

Finally, to display an icon on the identified location on Google maps, the `Marker` object is created. The `Marker` object's constructor sets the value for the properties, such as `position`, `map`, and `title`. The `position` property is specified with the location of the marker on the map. The `map` property is specified with the `Map` object to attach the marker with the map. Also, the `title` property sets the title to be displayed as a tooltip on the map.

As mentioned earlier, the `myOptions` object has several properties.

Table 14.7 lists some of these properties.

Property	Description
<code>zoom</code>	Sets the initial resolution at which map is displayed. A lower zoom value 0 represents a full map of the Earth. Similarly, a higher zoom value displays a map with high resolution. In Code Snippet 5, the zoom level is set to 16.
<code>center</code>	Centers the map on a specific point by creating an object of type <code>LatLng</code> which holds the location coordinates. In Code Snippet 5, the map is centered with the location coordinates <code>51.528663,-0.173171</code> . These coordinates display a map centered on Lord's Cricket Ground in London, England.
<code>mapTypeId</code>	Sets an initial map type. The map types supported are: <code>ROADMAP</code> for normal, <code>SATELLITE</code> for photographic tiles, <code>HYBRID</code> for roads and city names, and <code>TERRAIN</code> for water features. In Code Snippet 5, the map type has been set as <code>google.maps.MapTypeId.HYBRID</code> .

Table 14.7: Properties of the `myOptions` Object

Figure 14.6 displays the Map object on the Web page that is centered on Lord's Cricket Ground in London.

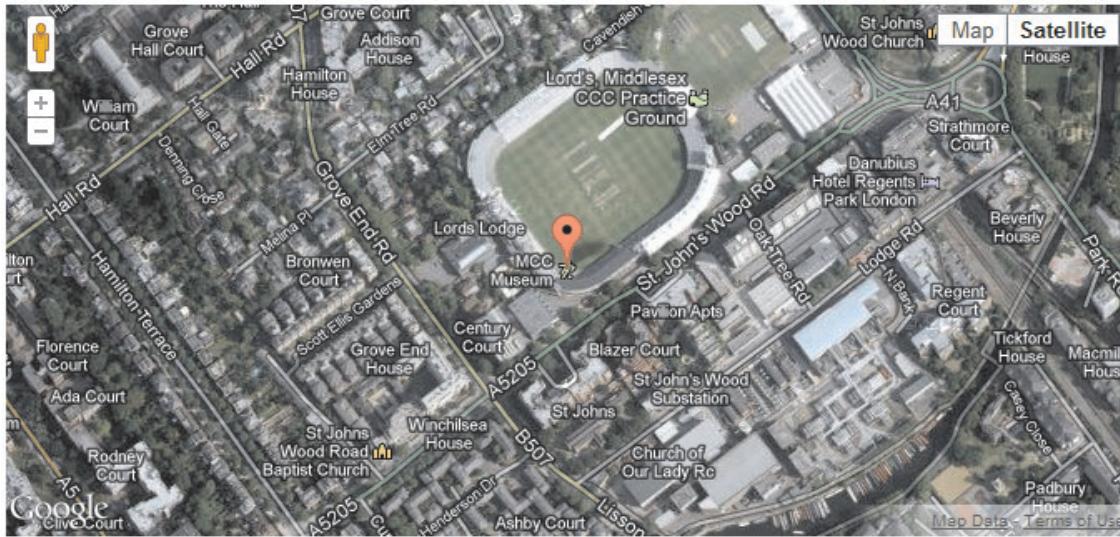


Figure 14.6: Map Object

14.4.1 Tracking User's Location on Google Maps

The Geolocation object is used by the Google Maps API to display the geolocation information in the applications.

Code Snippet 6 demonstrates the code that displays current location of a user on the map using Geolocation object.

Code Snippet 6:

```
<!DOCTYPE html>
<html lang="en">
<head>
<style>
    html, body {
        width: 100%;
        height: 100%;
        padding: 10%
    }
    #map_canvas {
        height: 50%;
        width: 50%;
    }
</style>
<script src="http://maps.google.com/maps/api/js?sensor=false">
</script>
```

```
<script>
// Check support for Geolocation in the browser
if (navigator.geolocation) {
    // Locate position and invoke function
    navigator.geolocation.getCurrentPosition(displayPosition,
                                              errorFunction);
} else {
    alert('Geolocation is not enabled in your browser');
}
// Success function
function displayPosition(position) {
    var my_lat = position.coords.latitude;
    var my_lng = position.coords.longitude;
    var div_info = document.getElementById('user_location');
    div_info.innerHTML = '<h1>Latitude is : ' + my_lat + ' and Longitude is
                           ' + my_lng + '</h1>';
// Load Google Maps
var latlng = new google.maps.LatLng(my_lat, my_lng);
var myOptions = {
    zoom: 2, //the initial resolution is set at which map is displayed
    center: latlng, //centers the map
    mapTypeId: google.maps.MapTypeId.ROADMAP //sets the map type
};
// Creates the Map object
var map = new google.maps.Map(document.getElementById("map_canvas"),
                            myOptions);
// Displays icon on the located position
var marker = new google.maps.Marker({
    position: latlng,
    map: map,
    title: "User location"
});
// Error callback function
function errorFunction(pos) {
    alert('Error!');
}
</script>
</head>
```

```
<body>
  <div id="map_canvas"></div>
  <div id="user_location"></div>
</body>
</html>
```

The code uses the `getCurrentPosition()` method and retrieves the current position of the user. Then, it passes the information to `displayPosition()` function, which retrieves the coordinates, latitude and longitude. The retrieved coordinates are set into the properties of the `Options` object named `myOptions` and initialize the `Map` object. Finally, the `Map` object is displayed along with the current position information in the `<div>` element.

Figure 14.7 shows the output displaying the current location of the user on Google Maps.



Latitude is :19.017656 and Longitude is 72.856178

Figure 14.7: Current User Location on Google Maps

14.5 Drag and Drop

HTML5 defines drag-and-drop operations that are based on events. The event-based mechanism allow the elements to be copied, reordered, or deleted on a Web page. The drag-and-drop operation involves the use of a pointing device, such as mouse on a visual medium. To perform the drag operation, a `mousedown` event is triggered followed by multiple `mousemove` events. Similarly, the drop operation is performed when a user releases the mouse.

The benefit of drag-and-drop mechanism is that it has brought the drag-and-drop operations on the browser level. This makes the programming easier, thus eliminating the requirement of complex JavaScript code written in earlier HTML versions.

Currently, drag-and-drop operations are supported by all major browsers.

14.5.1 Drag Operation

The steps required to make any element draggable on a Web page are as follows:

- Set the `draggable` attribute of an element to be dragged
- Set an `ondragstart` event on the element which stores the data being dragged
- Store the data into the `DataTransfer` object

Code Snippet 7 shows how to set the `draggable` attribute of an image element.

Code Snippet 7:

```
<!DOCTYPE html>
<html>
<head>
<title>Drag and Drop API</title>
</head>
<body>
<div id="div" style="border: 2px solid red; height:125px;
width:75px; padding: 10px">

</div>
</body>
</html>
```

In the code, the `` element contains `draggable` attribute that is set to `true`. The value `true` indicates that the element is eligible for dragging.

14.5.2 Drag Events

During various stages of the drag-and-drop operation, a number of events are fired. These events are mouse-based events.

Table 14.8 lists various events triggered during the drag operation.

Events	Description
dragstart	Triggers when an element is started to be dragged by the user
drag	Triggers when an element is being dragged using a mouse
dragleave	Triggers when the drag and drop operation is completed

Table 14.8: Drag Events

14.5.3 DataTransfer Object

The `dataTransfer` object reveals the **drag data store** that contains the dragged data in the drag-and-drop operation. It allows getting and setting of the data being dragged. In other words, the `dataTransfer` object holds the data during drag-and-drop operation.

The `dataTransfer` object enables to define two types of information. These are as follows:

1. The data type of the draggable element
2. The value of the data being stored in the data store

Code Snippet 8 demonstrates how to associate an element with `dragstart` event to store the data being dragged.

Code Snippet 8:

```
<!DOCTYPE html>
<html lang="en">
<head>
<title>Drag and Drop API</title>
<script>
function drag_image(event)
{
    event.dataTransfer.setData("image", event.target.id);
}
</script>
</head>
<body>
<div id="div1" style="border: blue 2px solid; height:125px;
width:75px; padding: 10px">

</div>
</body>
</html>
```

In the code, the `` element has been set with an event listener for the `dragstart` event. When the image is dragged, then, the `dragstart` event is fired and calls `drag_image()` function. The function uses the `dataTransfer` object to store the data during drag-and-drop operation. The string '`image`' represents the data type and `event.target.id` represents the value of `id` attribute of the draggable element.

Figure 14.8 shows the output of the image element to be dragged.



Figure 14.8: Output – Image to be Dragged

14.5.4 Drop Operation

After the element has been set up for dragging, it can be dropped on some element on the Web page. By default, elements on the page are not set up to receive dragged elements. Thus, the behavior of element acting as a drop element must be changed. This can be done by creating event listeners for the drop element. The drop element is also referred to as target element.

14.5.5 Drop Events

For any element to receive the drop operation, it must be associated with the drop events.

Table 14.9 lists the events of the drop operation.

Event	Description
dragenter	Triggers when a draggable element is being dragged on the target element for the first time
dragleave	Triggers when an element is dragged outside the target element
dragover	Triggers when an element is dragged inside the target element
drop	Triggers when an element is dropped in the target element

Table 14.9: Drop Events

Code Snippet 9 demonstrates how to set up event listeners to drop the image element on the target element.

Code Snippet 9:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <title>Drag and Drop API</title>
<script>
  function drag_image(event) {
```

```
        event.dataTransfer.setData("image", event.target.id);
    }
    function allow_drop(event) {
        event.preventDefault();
    }
    function drop_image(event) {
        var data=event.dataTransfer.getData("image");
        event.target.appendChild(document.getElementById(data));
    }
</script>
</head>
<body>
<div id="div1" style="border: blue 2px solid; height:125px;
width:75px; padding: 10px">
    
</div>
<br/>
<div id="div2" style="border: red 2px solid; height:125px;
width:75px; padding: 10px" ondrop="drop_image(event)"
ondragover="allow_drop(event)">
</div>
</body>
</html>
```

In the code, the `<div>` element with `id` attribute, set as '`div2`', is associated with two event listeners namely, `ondragover` and `ondrop`. The `ondropover` calls the `allow_drop()` function which prevents the default behavior of the target element. By default, the browsers do not support dropping of one elements on the other element. To prevent the default behavior, the statement, `event.preventDefault()` is invoked.

Then, the `drop` event is fired on the target element. It calls the function `drop_image()` which uses `getData()` method to retrieves image that is set as '`image`'. Finally, it appends the dragged image as a element into the target element, `div2`.

Figure 14.9 shows the output of the drop operation, after the image is dragged on the target element.

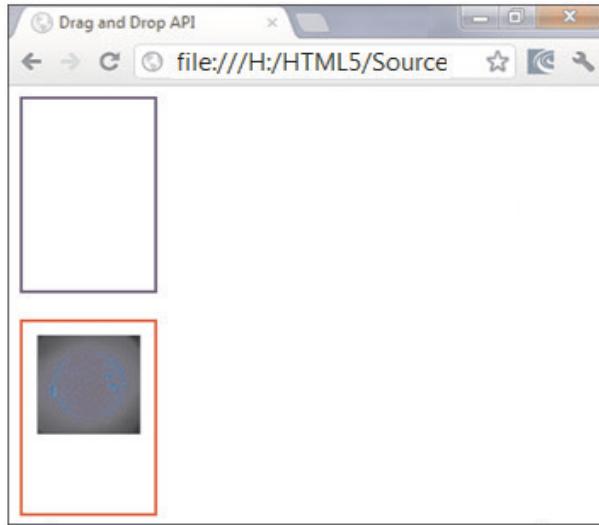


Figure 14.9: Output – Drop Operation

14.6 Offline Web Applications API

Consider a situation where a user is travelling outside the coverage area of Internet Service Provider (ISP). In this case, the user will not be able to access Web applications due to network connection failure.

HTML5 supports offline Web applications that allow a user to work with them without being online. Offline Web applications work by saving all the Web pages locally on the user's system. This feature is known as the **Application Cache**.

The **Application Cache** enables all resources, such as HTML, JavaScript, images, and CSS pages of a Web application to be stored locally on the system.

Following are the steps that can be taken to cache resources locally on the system:

1. Create a manifest file to define the resources that must be saved.
2. Reference the manifest file in each Web page designed to use cached resources.

14.6.1 Creating a Manifest File

The manifest file is a text file that defines the caching behavior for resources used by the Web page. The file should be saved with the `.manifest` extension.

Code Snippet 10 demonstrates how to create a manifest file.

Code Snippet 10:

```
CACHE:  
# Defines resources to be cached.  
check.js  
styles.css  
images/Figure1.jpg
```

```
FALLBACK:  
# Defines resources to be used if non-cached resources cannot be downloaded  
Other_images/ Figure2.png  
NETWORK:  
# Defines resources that will not be cached.  
Figure3.png
```

Following are the sections defined in the `.manifest` file:

- CACHE: This section defines resources, such as `check.js`, `styles.css`, and `Figure1.png` to be stored locally.
- FALLBACK: This section defines alternative resource to be used, when the actual resource is not available. For example, `Figure2.png` is defined as a fallback image. If a browser cannot access `Figure1.jpg` in the `images` folder, then `Figure2.png` will replace the unavailable image at the time of rendering the markup on the Web page. The unavailability of the image can be due to network connection or server problem.
- NETWORK: This section specifies resources to be accessed when there is a network connection. Resources in this section are not cached.

14.6.2 Declaring a Manifest

To associate a manifest with a Web page, assign `.manifest` file to the attribute named `manifest` specified with the `html` element.

Code Snippet 11 demonstrates how to add the `.manifest` file in an HTML document.

Code Snippet 11:

```
<!DOCTYPE html>  
<html manifest="appcache.manifest">  
  <head>  
    <title>Web Page </title>  
    <link rel="stylesheet" href="styles.css"/>  
    <script type="text/javascript" src="check.js"></script>  
  </head>  
  <body>  
    <input type="button" value="click Here..." onClick="display()"/>  
      
  </body>  
</html>
```

In the code, the "`appcache.manifest`" is specified with the `<html>` tag. The interpretation of the

manifest file is similar to any other file reference. The document uses a relative file path, as both the manifest file and HTML document are located in the same directory. By default, a Web page declaring manifest is cached automatically.

The benefit of the Application Cache is that it improves the performance of a Web page by reducing the number of requests made to the Web server. The Web server hosts the Web application to be accessed on the network.

Figure 14.10 shows how to enable the **Work Offline** mode in the Opera browser. This enables to cache the resources of the Web application pages locally.

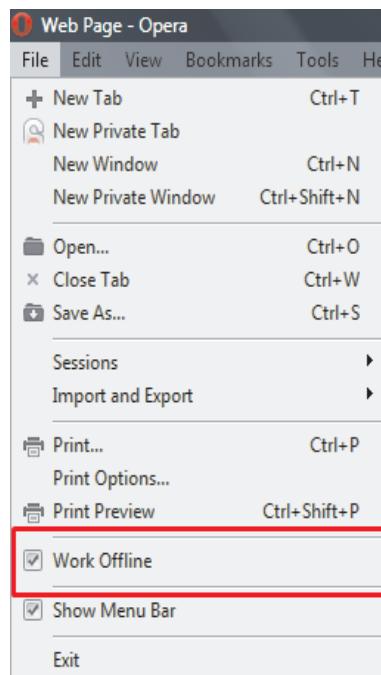


Figure 14.10: Work Offline Mode in Opera

As shown in Figure 14.10, **Work Offline** is enabled to cache the resources of the Web page.

Figure 14.11 shows the cached Web page in the Opera browser.

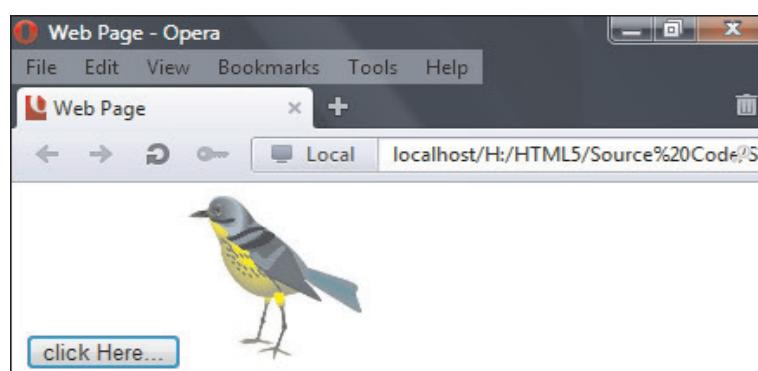


Figure 14.11: Output – Cached Web Page

14.7 Check Your Progress

1. The location of a user is represented as a single _____ on a map.

(A)	Point	(C)	Mark
(B)	Coordinates	(D)	Symbol

2. Which one of the following new properties of the navigator object is supported by HTML5?

(A)	Location	(C)	Geolocation
(B)	Cookie	(D)	Script

3. Which one of the following objects enables to get and set the data of the element being dragged?

(A)	dragstart	(C)	drop
(B)	dataTransfer	(D)	drag

4. Identify the steps required to cache the resources of a Web page locally on the system.

(A)	Obtain the resource from online	(C)	Create a manifest file
(B)	Reference the manifest file in a Web page	(D)	Create the object of the manifest file in JavaScript

5. Which of the following is the correct code to load the coordinates on the Google Maps?

(A)	<pre>function displayPosition(position) { var my_lat = position.coords.latitude; var my_lng = position.coords.longitude; var latlng = new google.maps.LatLng(my_lat, my_lng); }</pre>
(B)	<pre>function displayPosition(position) { var my_lat = position.coords.latitude; var my_lng = position.coords.longitude; var latlng = new google.maps.LatLng(my_lat, my_lng); }</pre>
(C)	<pre>function displayPosition(position) { var my_lat = coords.latitude; var my_lng = coords.longitude; var div_info = document.getElementById('user_location'); var latlng = new google.maps.LatLng(my_lat, my_lng); }</pre>
(D)	<pre>function displayPosition(position) { var my_lat = position.coord.latitude; var my_lng = position.coord.longitude; var latlng = new google.maps.LatLng(my_lat, my_lng); }</pre>

14.7.1 Answers

1.	A
2.	C
3.	B
4.	B, C
5.	A

Summary

- Geolocation determines the current location of a user on devices.
- The location is represented as a single point on a map that comprises two components: latitude and longitude.
- The Geolocation API is a specification provided by the W3C which provides a consistent way to develop location-aware Web applications.
- Google Maps API is used to display the user's location on the map.
- The object of type Map is created in JavaScript, before it can be referenced in an HTML document.
- The drag-and-drop operations defines an event-based mechanism using which elements on a Web page can be copied, reordered, or deleted.
- HTML5 supports offline Web applications that allow a user to work with them without being online.

Try It Yourself

1. Develop a mobile Web application to display the current location of a user on Google Maps. The application will make use of jQuery API to handle success and failure conditions, while gathering information about the user location.
2. Create a Web page with a container containing three images and two empty containers. The user can drag the images from the container and drop them in the empty containers back and forth.



Session - 15

Building Mobile Websites

Welcome to the Session, Building Mobile Websites. This session gives a brief introduction of HTML5 framework and illustrates importance of creating a responsive Web page.

In this Session, you will learn to:

- ➔ Identify necessity for mobile Websites
- ➔ List and describe various HTML5 frameworks and their features
- ➔ Summarize importance of creating a responsive Web page
- ➔ Illustrate steps to create a responsive Web page by applying HTML, CSS, and JavaScript

15.1 Necessity for Mobile Website Development

The trend of viewing Websites on mobile screens has been on the rise. It is no longer limited to larger screens such as laptops and desktops. As a result, it has become essential for Web developers to design a Web page that is responsive. Responsive design refers to the practice of creating Websites or applications that can adjust their layout and content to suit various screen sizes and devices. This enables users to enjoy a consistent and optimal browsing experience, irrespective of the device in which the Website is viewed.

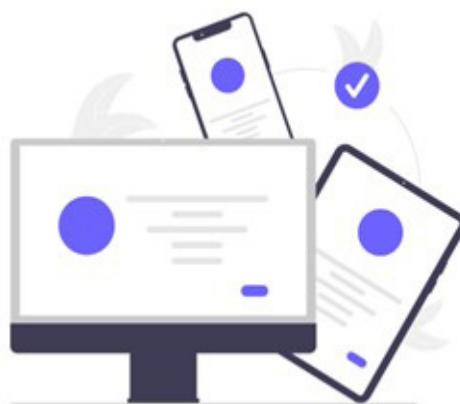
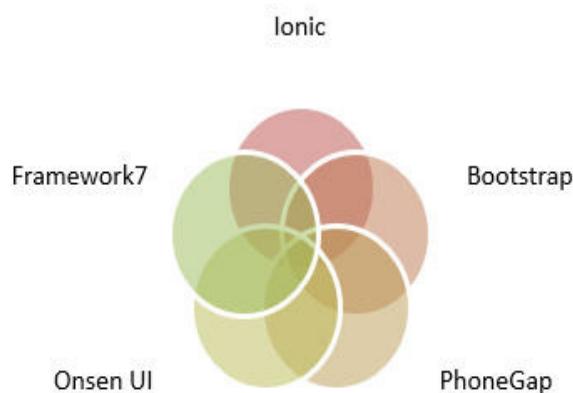


Figure 15.1: Responsive Approach

15.2 Introduction to HTML5 Frameworks for Mobile Development

For the Web developers, who are only accustomed to working with HTML, CSS, and JavaScript, creating a native mobile app can be uncharted territory. Essentially, the programming languages employed to develop mobile apps for Android, iOS, and so on are entirely unique from one another. Their learning curve can also be steep.

To facilitate development of a mobile equivalent of Websites, several HTML5 frameworks are available. They include pre-built components and templates aiding in the simplification of the development process. Some of them are outlined as follows:



Frontend Technologies for Beginners

- **Ionic** – Ionic is a widely used open-source framework that allows developers to build mobile applications utilizing Web technologies such as HTML, CSS, and JavaScript. It provides a rich set of UI components and pre-built themes that help developers build attractive Web pages that work seamlessly across different mobile applications. Ionic is a popular framework as it is easy to understand, flexible, and creates high quality mobile applications with minimal effort.
- **Bootstrap** – Bootstrap is a popular mobile framework for building HTML5-based mobile Web applications. It has variety of pre-built UI components, templates, and other tools for building mobile-friendly Web applications. It is a great choice for building mobile Web applications as it allows developers to create applications that automatically adapt to different screen sizes and devices (responsive Web pages).
- **PhoneGap** – PhoneGap is a mobile application development framework that utilizes HTML5, CSS, and JavaScript to create cross-platform mobile applications that enables developers to create applications that can run on multiple platforms, such as desktop, Web, and mobile.
- **Onsen UI** – Onsen UI is an HTML5-based mobile app development framework that utilizes Web technologies such as HTML, CSS, and JavaScript to create cross-platform mobile applications. Onsen UI provides a set of pre-built UI components and tools that allow developers to create high-quality, responsive mobile applications that can run on various platforms, including iOS and Android.
- **Framework7** – Framework7 is a comprehensive HTML5 framework used for creating native mobile applications for iOS and Android devices. It includes pre-built UI components, animations, and other native functionalities.

Each framework is unique in its own way but has limitations as well. Based on the development objectives and requirements, the best framework can be chosen. Some of them also require additional skillsets to work with them.

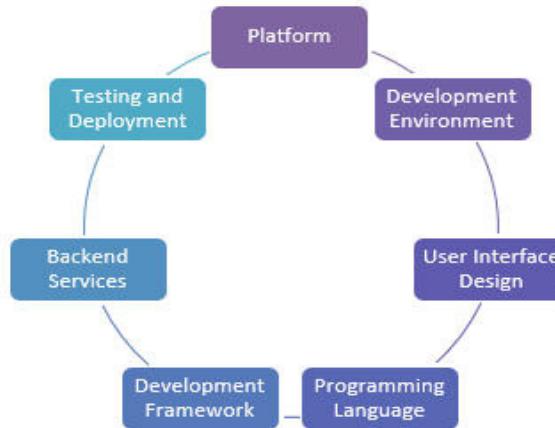
15.3 Basic Requirements for Mobile Application Development

Besides developing mobile Websites, developers can also build mobile applications.

Developing a high-quality and successful mobile application requires careful consideration of various requirements and best practices. For instance, determining the target platform for creating the apps and the target audience. While developing an application, the User Interface (UI) has to be given importance. The UI decides how well the user can navigate through the app. For this reason, the UI has to be simple yet intuitive. It should ensure optimal performance and security. A thorough testing should be conducted to eliminate bugs and errors. Maintaining the application over time is critical to fixing bugs, adding features, and ensuring compatibility with the latest operating systems and devices. Following these guidelines, the developer can develop a mobile application that meets the highest standards of quality and delivers a great user experience.

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Some of the basic requirements to be considered while developing a mobile application with HTML5 is illustrated as follows:



- **Platform** – Determine the platform to develop the app. The two prominent ones are Android and iOS. Android is an open-source operating system developed by Google for mobile devices and iOS is a mobile operating system developed by Apple Inc. specifically for its mobile devices. Each has its own development tools, requirements, and guidelines. The developer can also consider building a cross-platform app to target both platforms simultaneously.
- **Development Environment** – According to the platform chosen, one can install the necessary Software Development Kits (SDKs) for the platform. Install the development tools, emulators, or other testing tools, debugging tools, and so on.
- **User Interface Design** – The UI should be creative, visually appealing, and user-friendly. Consider platform-specific UI guidelines and best practices. To accomplish these tasks specialized tools such as Adobe XD, Sketch, or Figma can be utilized.
- **Programming Language** – A programming language as per the platform chosen should be used. For example, Swift or Objective-C are suitable for iOS, and Java or Kotlin for developing Android applications.
- **Development Framework** – Development frameworks such as Ionic, React Native, or Xamarin can be utilized as per the requirement. Each framework provides tools and libraries that streamline the development process, such as automated testing tools, code optimization tools, and debugging tools.
- **Backend Services** – When developing a mobile application, it is important to plan and integrate any backend services that the application requires. This includes a database for storing data, authentication for user login and security, and push notifications for sending messages to users.
- **Testing and Deployment** – As a final step, it is essential to test the newly created application on

different devices and platforms, and perform any necessary adjustments to ensure that the application is functioning correctly and meets the intended requirements. Finally, after rigorous testing, deploy the application to the respective app store for distribution. This involves submitting the application to the Apple App Store or Google Play.

15.4 Understanding Responsiveness of Websites

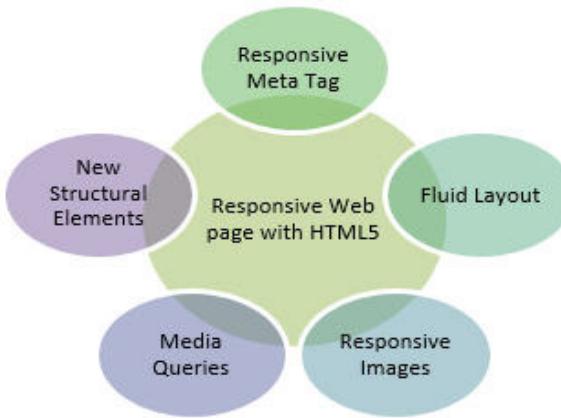
In today's digital world, Web applications are viewed on different devices with different screen sizes. It is, therefore, essential to build a responsive Web page that adapts well to different screen sizes and devices, ensuring a consistent user experience across desktop computers, laptops, tablets, and smartphones.

The main goal of responsive Web design is to create a flexible and user-friendly Website that can be accessed from any device, without sacrificing usability or readability. Responsive Websites utilize a combination of fluid grids, flexible images, and CSS media queries to adjust the layout and content of a Website based on the screen size and orientation of the device that accesses it.

Responsive design is crucial in today's digital landscape as more and more people utilize mobile devices to access the Internet. A responsive Website can improve the user experience, increase engagement, and boost conversion rates, ultimately leading to greater success for businesses and organizations.

15.4.1 Responsiveness via HTML5

HTML5 is a markup language that includes many new features and improvements over its predecessors, including built-in support for responsive design. Responsive design in HTML5 involves applying a range of techniques such as utilizing responsive meta tag, fluid layout, responsive images, media queries, and HTML5 structural elements.



- ➔ **Responsive meta tag** – HTML5 introduced viewport meta tag, `<meta>`, that allows creating a responsive viewing area for the users. It allows designers to control the width and scaling of the Web page which is an important aspect for mobile devices. The viewport meta tag in the HTML code ensures optimal display of the Web page on different devices.
- ➔ **Fluid layout** – Fluid layouts consider relative units such as percentages, rather than fixed units such as pixels, for sizing elements on the Web page. This ensures that the Web page can adjust

and reflow its content to fit different screen sizes.

- ➔ **Responsive images** – Another important feature of HTML5 is including functionality to create responsive images. HTML5 introduces the `<picture>` element and `srcset` attribute. The `<picture>` element allows developers to specify multiple sources for an image, with different resolutions or formats, and the browser chooses the appropriate source based on the device's characteristics, such as the screen size or pixel density. The `srcset` attribute allows designers to specify different image sources for different screen sizes. This ensures that images are optimized for the specific device allowing faster loading times and better display quality.
- ➔ **Media queries** – Media queries enable designers to apply different styles or layouts to Web pages depending on the size of the screen or device.
- ➔ **HTML5 structural elements** – A variety of new structural elements are introduced in HTML5 such as header, footer, and section that allow designers to create a semantic structure for the Web page. This makes it easier for screen readers and search engines to understand the content of the Web page and improves accessibility.

15.4.2 Responsiveness via CSS

HTML5 along with CSS, especially CSS3, can produce a responsive Web page. Some of the most common CSS techniques for creating a responsive Web design is as follows:



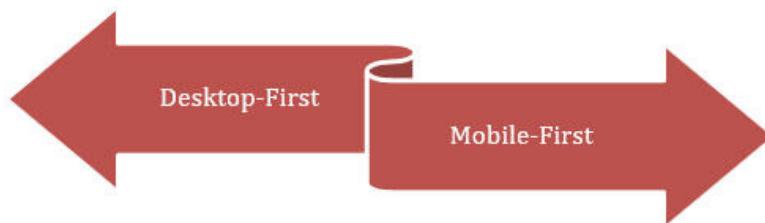
- ➔ **Media Queries** – Media queries are a powerful feature in CSS that allow Web designers to create responsive Web designs that adjust to different screen sizes and devices. By setting specific CSS styles for different screen sizes, designers can ensure that the page looks great on any device. For example, the developers can specify which elements to hide or repositioned on smaller screens to ensure a better user experience.
- ➔ **Fluid Layouts** – Fluid layouts apply relative units such as percentages rather than fixed units such as pixels, for sizing elements on the page. This ensures that the page can adjust and reflow its content to fit different screen sizes. For example, if an element is set to 50% width, it always assumes half of its parent container's width, regardless of the screen size. Thus, ensuring

responsiveness in the created page.

- **CSS Grid and Flexbox** – CSS Grid and Flexbox are the two layout modules in CSS that provide flexible and dynamic ways to structure and position content on a Web page. These modules enable designers to create fluid and responsive layouts that adjust to different screen sizes and device types. CSS Grid is a two-dimensional layout system that allows designers to create grid-based layouts with rows and columns. Flexbox, on the other hand, is a one-dimensional layout system that allows designers to create flexible layouts with elements arranged either in a row or column. Both CSS Grid and Flexbox offer powerful tools for creating fluid and responsive layouts that can adapt to a wide range of screen sizes and device types.
- **Responsive Typography** – CSS supports responsive typography that can adjust to different screen sizes and devices. This is done by utilizing relative units for font sizes and line heights, as well as adjusting the font size and spacing for different screen sizes.
- **Responsive Images** – CSS can also be used to optimize images for responsive Web design. Techniques such as max-width property to set maximum size of images. The max-width property ensures that the size of the image is always within the size of the container.

15.5 Desktop-First and Mobile-First Approach

Desktop-first approach and mobile-first approach are two different approaches to designing and developing responsive Websites that are optimized for different devices and screen sizes. The digital age has revolutionized how Websites are developed.



15.5.1 Desktop-First Approach

Desktop-first is a design approach in which the design and development of a Website or application begins with the desktop version and then, extends to mobile and tablet versions. The layout and features are designed keeping in mind the desktop users. This design is then optimized for smaller screens such as tablets and mobile devices by scaling the desktop layout to suit the smaller screens. Figure 15.2 illustrates a desktop-first approach.

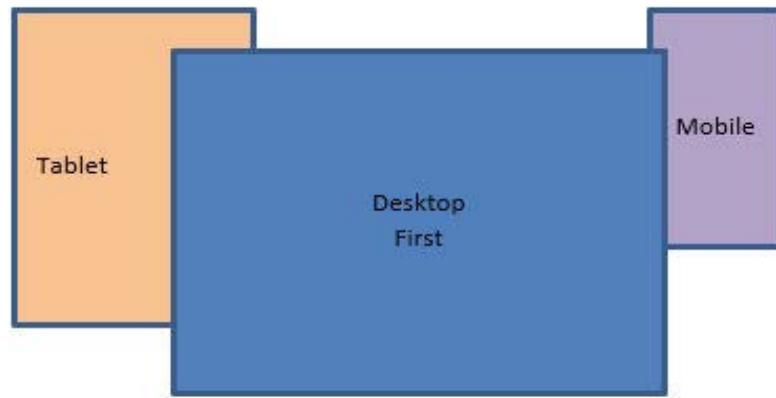


Figure 15.2: Desktop-First Design

15.5.2 Mobile-First Approach

Mobile-first approach is designed keeping in mind the mobile users first and then, the design and layout is scaled up to tablet and desktop versions. Figure 15.3 illustrates a mobile-first approach.

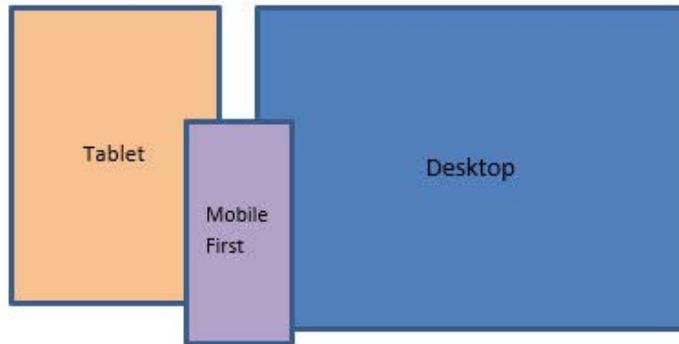


Figure 15.3: Mobile First Design

15.5.3 Key Difference Between Mobile-First Approach and Desktop-First Approach

The trend is now creating Web pages utilizing the mobile-first design as the preferred approach to designing. This is because more and more people view the Web application in their mobile devices. This approach puts greater emphasis on creating responsive and user-friendly designs for smaller screens. Here, the target audience are mobile users. Therefore, this design prioritizes the requirements of the mobile users rather than the larger screen users. The design elements optimized for smaller screens and touch interactions. It then scales up to the design requirements of the tablet and desktop users aiming to create a seamless user experience across all devices, regardless of screen size.

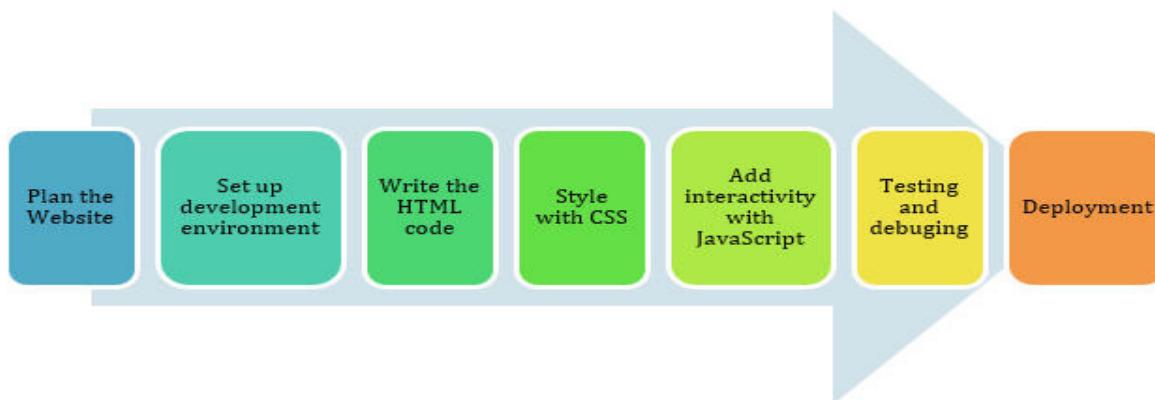
The desktop-first approach is designed for larger screens first assuming that larger screens have more processing power, more stable Internet connections, which allows for more complex and visually-

rich designs. Desktop-first design tends to focus on visual appeal, complex interactions, and usage of multimedia elements, with the design elements optimized for larger screens and mouse interactions. It is then scaled to adapt to the smaller screens as well to make the Web app responsive.

Depending on the specific requirements of the Website as well as based on the target audience, either of the two approaches has to be chosen. Both approaches are unique in their own way and have their own benefits and drawbacks. The desktop-first creates a Web page that looks more visually impressive and detailed designs for larger screens, while the mobile-first approach can ensure that the Website is optimized for mobile devices. As previously discussed, this approach has become increasingly popular for Web designing.

15.6 Building Mobile Site with HTML5, CSS, and JavaScript

Few key steps while building a mobile Website is discussed as follows:



- **Plan the Website** – The first step to building a Website would be to plan out a layout as well as content and design. The best way to do this is to create wireframes, sitemaps, and mockups.
- **Set up the development environment** – This step involves installing a code editor, a Web server, and a browser.
- **Write the HTML code** – Start the coding part by writing HTML. HTML is the language to create the structure and content of the Website. It is called the backbone of any Website. HTML code defines different elements of the Website such as headings, paragraphs, images, and links. Bootstrap classes speed up the process of making responsive Web pages.
- **Style with CSS** – CSS adds style to the Website to make the Web page visually appealing. CSS codes define colors, fonts, layout, and other visual elements of the site.
- **Add interactivity with JavaScript** – JavaScript adds interactivity to the Website, such as animations, user input validation, and dynamic content.
- **Testing and debugging** – As a final step to building the Web page, performing testing and debugging is an extremely important step. This ensures the Website is working as expected.

If there is a bug, the code has to be debugged before it is deployed.

- ➔ **Deployment** – Finally, it is time to deploy the Website to a Web server so that it can be accessed by visitors. This typically involves uploading the HTML, CSS, and JavaScript files to a hosting provider and configuring a domain name and server settings.

There are several approaches to develop a mobile Website. Some of them are listed as follows:

HTML Meta Viewport Tag – The HTML meta viewport tag is an important tool for optimizing Website layout on mobile devices. It allows adjusting the width and scale of the viewport. It is important to set this tag correctly to ensure that the Website is user friendly on devices of varying sizes. Let us first see how a mobile Website looks like, without use of meta viewport tag. Later, we will apply viewport tag to the same code and compare the differences. Code Snippet 1 illustrates the code without any usage of meta viewport tag.

Code Snippet 1:

```
<html>
<head>
<title>Building Mobile Responsive Websites with HTML5 and CSS</title>
</head>
<body>
  <header> Mobile Design </header>
  <NAV>
    <a href="home.html">Home</a> |
    <a href="aboutUs.html">About Us</a> |
    <a href="contactUs.html">Contact Us</a>
  </NAV>
  <section id="intro">
    <p>This is the introductory text to my mobile Web application.</p>
    <p>
  Cross-platform mobile development is more important than cross-browser
development. As it is practically impossible to test on all mobile devices,
developers long for the day when they simply had to support legacy browsers.
</p>
</section>
</body>
</html>
```

Launch this code in Chrome browser and use **More Tools → Developer Tools** and then, select an appropriate mobile device size, for example, Samsung Galaxy S20. Alternatively, launch Microsoft Edge browser and on the toolbar, select **Settings and more () → More tools → Developer tools** and then, click **Toggle device emulation**. This brings up the **Device Emulation** tool of Microsoft Edge.

The output obtained using either of these approaches is shown in Figure 15.4.

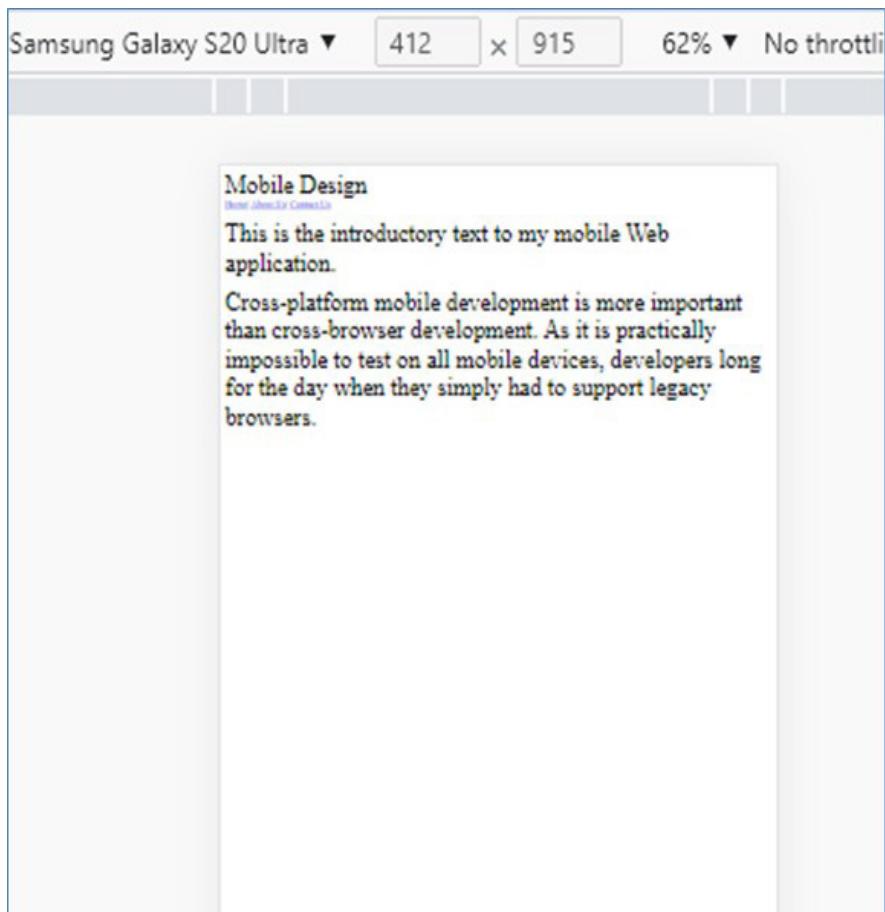


Figure 15.4: Output of Code Snippet 1

As you can observe, the menus do not look clearly visible because of rendering on the browser emulator.

To rectify this, add `viewport` meta tag. The Website now adjusts its layout and scale according to the size of the user screen. The updated code is as shown in Code Snippet 2.

Code Snippet 2:

```
<html>
  <head>
    <meta name="viewport" content="width=device-width, user-scalable=no">
    <title>Building Mobile Responsive Websites with HTML5 and CSS</title>
  </head>
  <body>
    <header> Mobile Design </header>
    <NAV>
      <a href="home.html">Home</a> |
      <a href="aboutUs.html">About Us</a> |
    </NAV>
  </body>
</html>
```

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```
<a href="aboutUs.html">About Us</a>|
<a href="contactUs.html">Contact Us</a>
</NAV>
<section id="intro">
<p>This is the introductory text to my mobile Web application.
</p>
<p>
Cross-platform mobile development is more important than cross-browser
development. As it is practically impossible to test on all mobile devices,
developers long for the day when they simply had to support legacy browsers.
</p>
</section>
</body>
</html>
```

The output obtained for the modified code in the browser emulator is as shown in Figure 15.5.

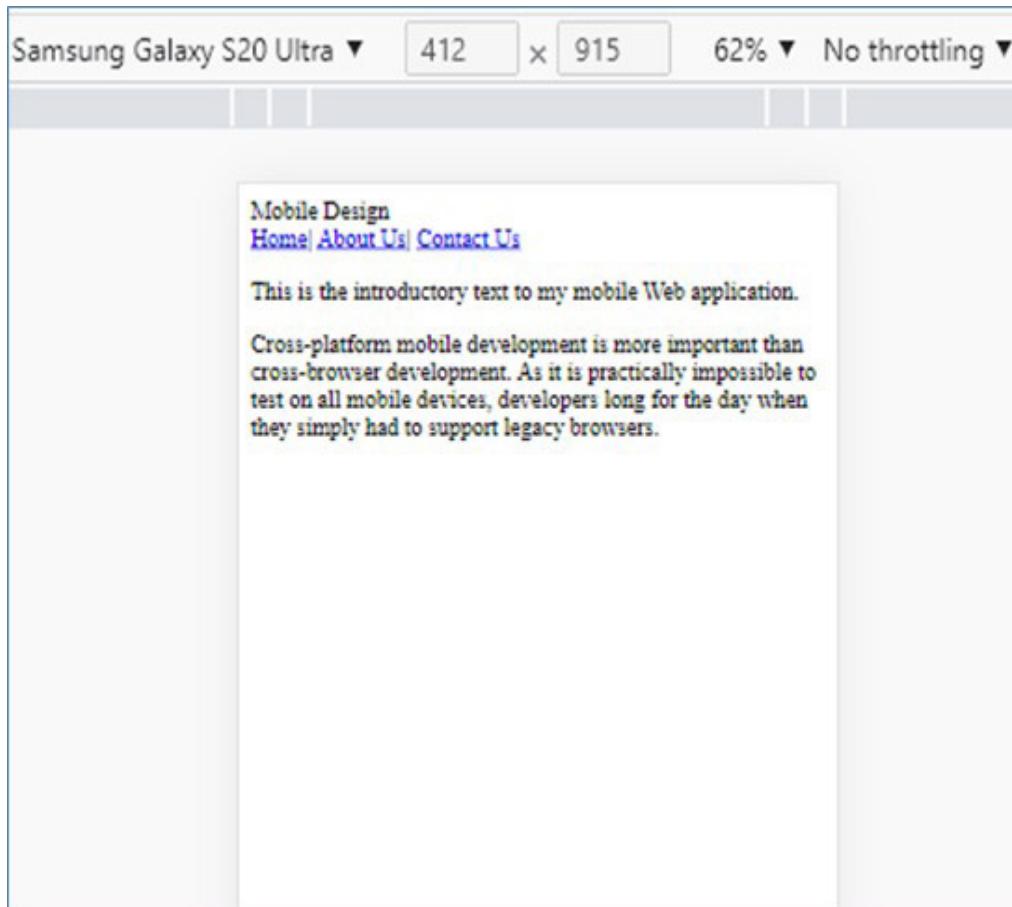


Figure 15.5: Output of Code Snippet 2

Compared to Figure 15.4, Figure 15.5 is better optimized for viewing on mobile screens.

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Existing CSS Functionality – CSS has a variety of properties to arrange images for mobile devices, including max-width, min-width, and media queries. These properties can be utilized to ensure optimum images for different screen sizes.

For example, consider adding image to Code Snippet 2. This is shown in Code Snippet 3.

Code Snippet 3:

```

```

The output obtained is as shown in Figure 15.6.

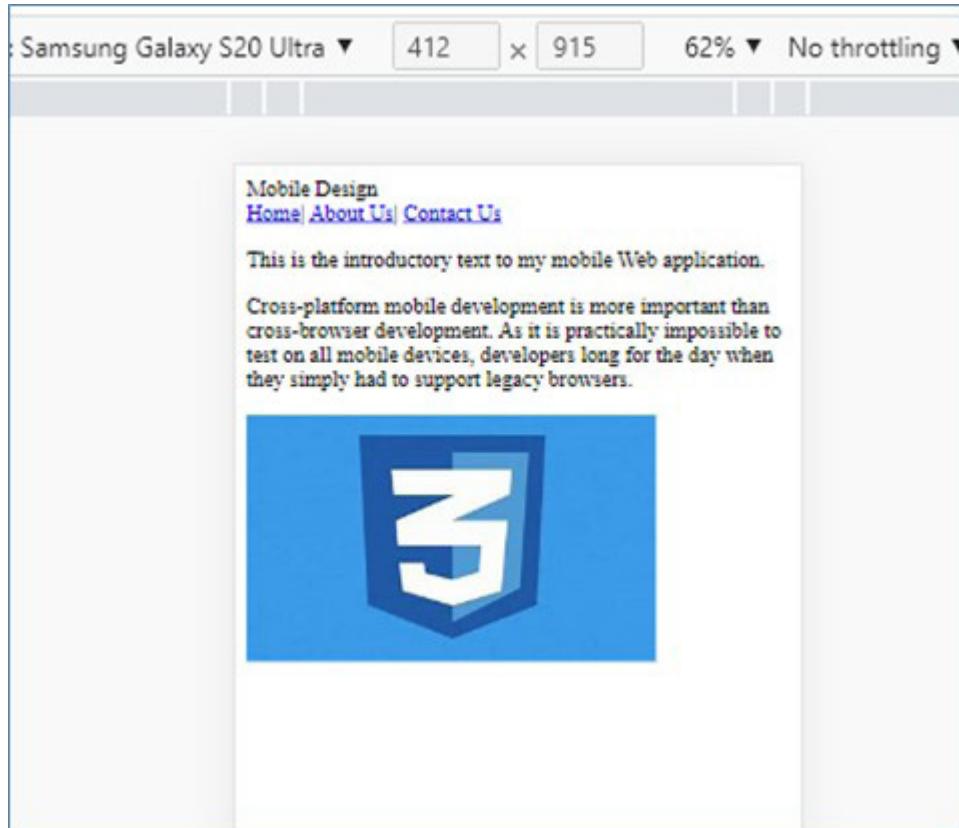


Figure 15.6: Output of Code Snippet 3

Within inline styles, define specifications as shown in Code Snippet 4.

Code Snippet 4:

```
<style>  
img {  
    width: 100%;  
    height: auto;  
}  
</style>
```

The updated output is as shown in Figure 15.7.

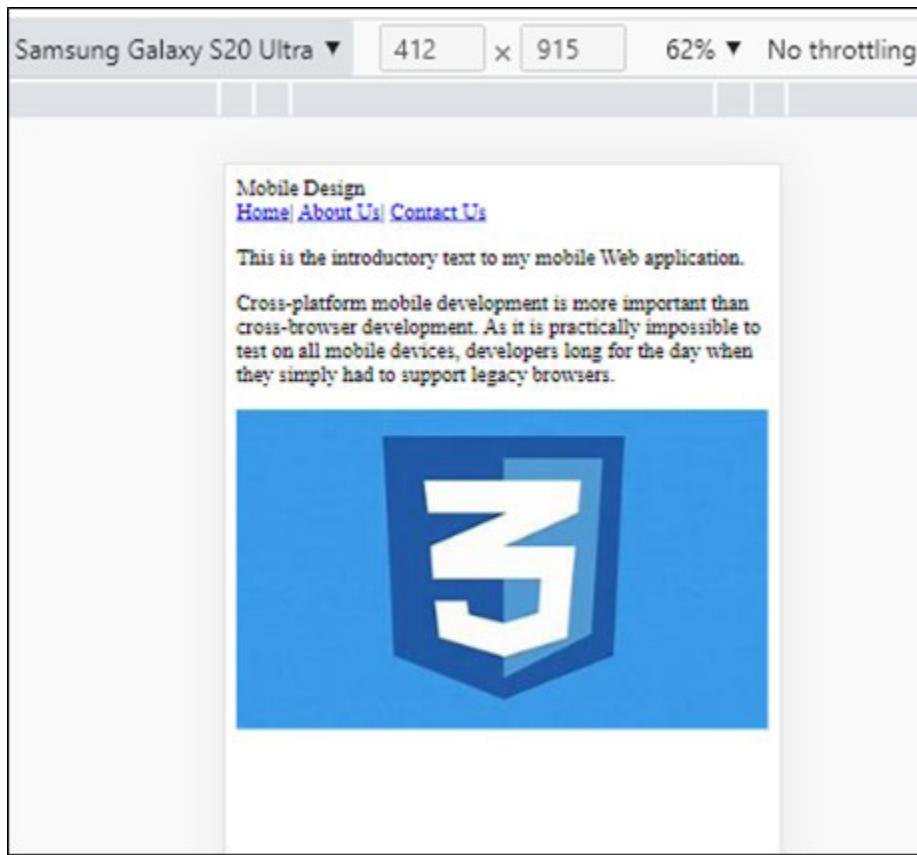


Figure 15.7: Output of Code Snippet 4

The output generated has a visually appealing design. The width of the image tag is defined as 100%, utilizing percentage units instead of static units such as px, inch, or em. This ensures that the image is fully responsive and adapts to the screen size of the device it is being viewed on.

Implementation of CSS3 @Media – The @media rule is a CSS rule that enables Web developers to create responsive designs that adapt to the device and screen size on which a Website is being viewed, allowing for targeted styles that only apply in certain situations, such as specific screen width or device orientation, and ensuring that Websites are visually appealing and user-friendly across all devices.

For example, to provide color to the background, a simple CSS specification can be applied as shown in Code Snippet 5.

Code Snippet 5:

```
body {  
    background-color: lightblue;  
    color: white;  
}
```

The output obtained is shown in Figure 15.8.

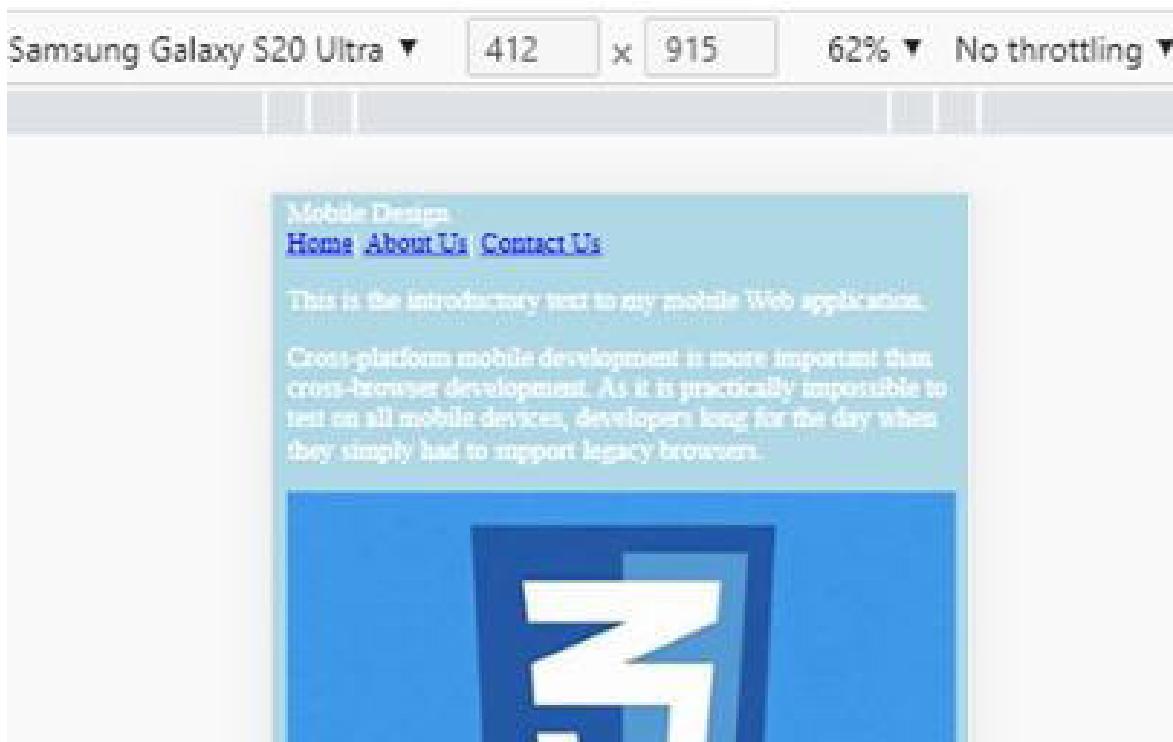


Figure 15.8: Output of Code Snippet 5

Now, add the @media rule along with `max-width` as shown in Code Snippet 6.

Code Snippet 6:

```
@media screen and (max-width: 600px) {  
    body {  
        background-color: blue;  
        color: white;  
    }  
}
```

Code Snippet 6 sets the background color to lightblue and the text color to white only when the screen width is less than or equal to 600 pixels. This is often applied to optimize the Website for mobile devices or smaller screens. The output obtained is shown in Figure 15.9. Here, the width is more than 600 pixels, hence, the background is not changed and remains as lightblue.

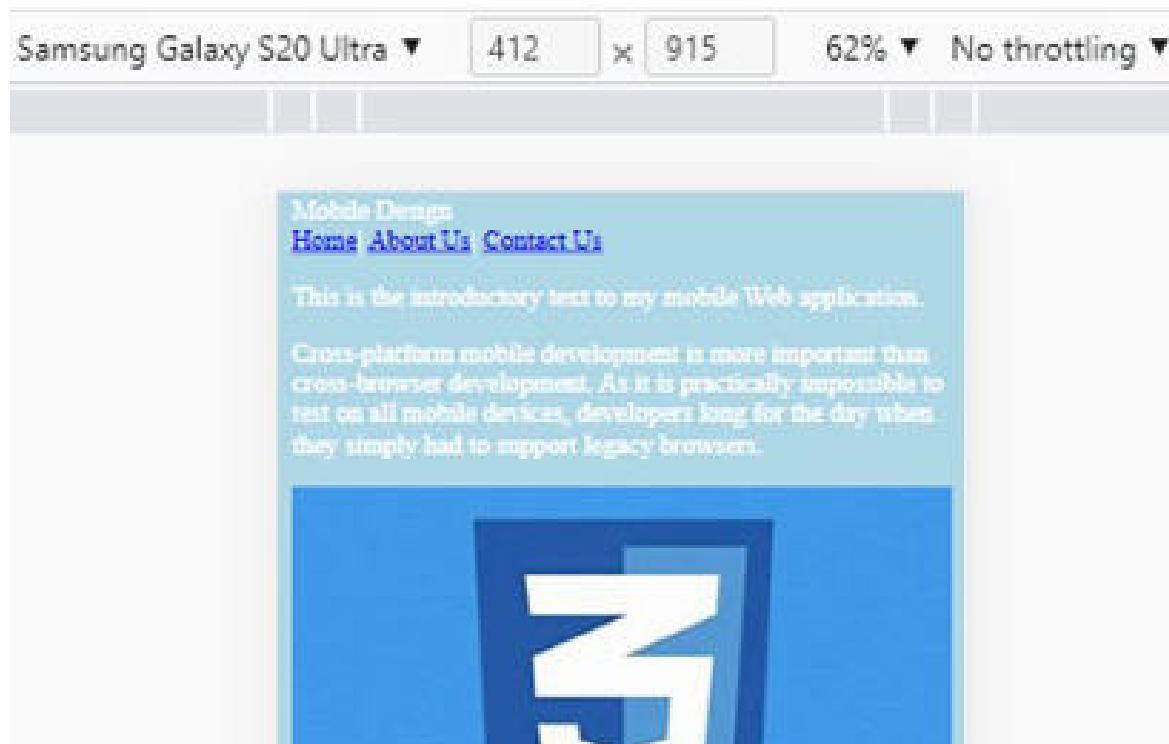


Figure 15.9: Output of Code Snippet 6

Now, consider Code Snippet 7.

Code Snippet 7:

```
@media screen and (max-width: 992px) {  
    body {  
        background-color: lightblue;  
        color: green;  
    }  
}  
  
@media screen and (max-width: 600px) {  
    body {  
        background-color: lightblue;  
        color: white;  
    }  
}
```

Code Snippet 7 demonstrates the `@media` rule in CSS to apply different styles to the `body` element based on the screen size of the device. Specifically, if the screen size is less than or equal to 992px, a lightblue background color and green text color is applied to the `body` element, while if the screen size is less than or equal to 600px, a lightblue background color and white text color is applied instead. The output obtained is shown in Figure 15.10. Observe the green text color.

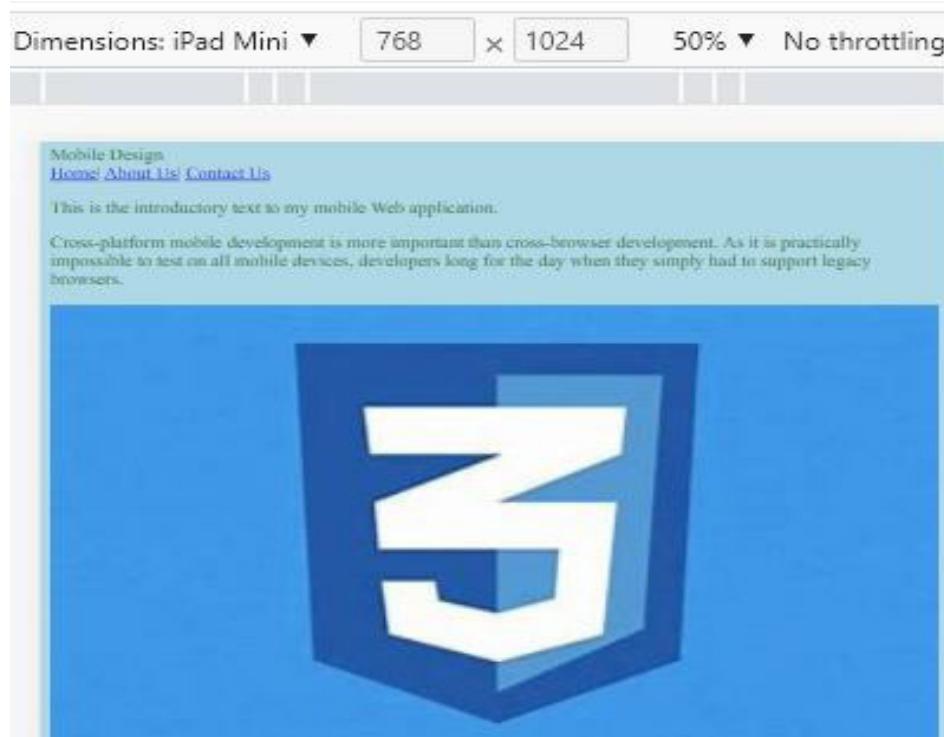


Figure 15.10: Output of Code Snippet 7

One Column To Summarize All Text Columns – On mobile devices, it is important to keep things simple and easy to read. Utilizing a single column layout for text ensures that the content is easy to read and understand on smaller screens. This is because mobile devices have limited horizontal space, therefore, it is wise to stack the content vertically in columns. To understand this, consider Code Snippet 8.

Code Snippet 8:

```
<div id="main">  
    This main DIV tag is used as a testing part of Mobile page development  
</div>  
  
<div id="submain">  
    This sub main DIV tag is used as a testing part of Mobile page development  
</div>
```

Here, two div tags are added to the same Web page. The appropriate CSS code is as shown in Code Snippet 9.

Code Snippet 9:

```
#main, #submain  
{  
    float: left;  
    padding: 0;
```

```
width: 95%;  
margin: 2%;  
text-align: justify;  
}
```

Here, the code defines two text columns namely, #main and #submain. The #submain column stacks on top of the #main column if both columns are set to float: left. The two columns have the same width, alignment, and margin spaces as they are defined with identical structure definitions.

The complete code for the mobile Website is given in Code Snippet 10.

Code Snippet 10:

```
<html>  
<head>  
<title>Building Mobile Responsive Websites with HTML5 and CSS</title>  
<meta name="viewport" content="width=device-width, user-scalable=no">  
<style>  
@media screen and (max-width: 992px) {  
    body {  
        background-color: lightblue;  
        color: green;  
    }  
}  
@media screen and (max-width: 600px) {  
    body {  
        background-color: lightblue;  
        color: white;  
    }  
}  
img {  
    width: 100%;  
    height: auto;  
}  
#main, #submain  
{  
    float: left;  
    padding: 0;  
    width: 95%;  
    margin: 2%;  
    text-align: justify;  
}
```

```
</style>
</head>
<body>
  <header> Mobile Design </header>
  <NAV>
    <a href="home.html">Home</a> |
    <a href="aboutUs.html">About Us</a> |
    <a href="contactUs.html">Contact Us</a>
  </NAV>
  <section id="intro">
    <p>This is the introductory text to my mobile Web application.</p>
    <p>Cross-platform mobile development is more important than cross-browser development. As it is practically impossible to test on all mobile devices, developers long for the day when they simply had to support legacy browsers.</p>
    
  </section>
  <div id="main">
    This main DIV tag is used as a testing part of Mobile page development
  </div>
  <div id="submain">
    This sub main DIV tag is used as a testing part of Mobile page development
  </div>
</body>
</html>
```

15.7 Implementation of Responsiveness in Existing Site

As discussed earlier, making a page responsive is the key to a satisfied user. Responsiveness is essential for providing a positive user experience across different devices and screen sizes. A responsive Website adjusts its layout and content to fit the screen size of the device being used, whether it is a desktop computer, laptop, tablet, or smartphone. This ensures that users can easily access and navigate the Website, no matter the size of the device. Some of the key steps to make a responsive Web page is discussed as follows:

- **Design with responsiveness in mind** – The very first step to making a Web page is planning. This includes planning the layout, color, fonts and so on. One has also to have in mind that the page is viewed by a desktop user, tab user, or even small screen mobile device users. So, while designing a Web page, it should be kept in mind that the page has to be responsive for an optimum user satisfaction.

- **Plan the content hierarchy** – This implements that the most relevant information should be at the top of the hierarchy. This creates a good user experience.
- **Optimize images and media** – Large images and videos can slow down the Website. These contents are difficult to load on the mobile device. It is, therefore, recommended to include images and other media such that they do not hamper the loading of the Website.
- **Responsive design tools** – There are many design tools, such as Google mobile-friendly test, Responsinator, and so on, that are available that allows previewing the design on different screen sizes. Utilizing these tools makes sure the Website looks good on all devices.
- **Test the Website** – This is the last and important step by which the developer can test if everything works as per the plan.

An existing site can be made responsive by adding viewport meta tag. The viewport size varies based on the sizes and orientations of the screens. The `<meta>` tag in HTML allows to specify the viewport.

Code Snippet 11 illustrates adding a `viewport` meta tag to the HTML code.

Code Snippet 11:

```
<html>
<head>
<title>
<meta name="viewport" content="width=device-width, initial-scale=1">
</title>
</head>
<body>
<div>
    <h1 style="font-size:5vw;">My Demo Page</h1>
    <p style="font-size:3vw;">Different Operating System Lists</p>
</div>
<div>
    <div>
        <div>
            <h3>Startups</h3>
            <p style="font-size:3vw;">Billy Johnson</p>
            <p style="font-size:3vw;">The startup created and distributes a
            number of proprietary graphical operating system families under the name
            BillyStartup</p>
        </div>
    </div>
</div>
```

```
<div>
  <h3>Startup1</h3>
  <p style="font-size:3vw;">Linus</p>
  <p style="font-size:3vw;">This is the best organization that created
an operating system kernel. It is an open-source operating systems</p>
</div>
<div>
  <h3>Startup2</h3>
  <p style="font-size:3vw;">Stephen</p>
  <p style="font-size:3vw;">Stephanos is an upcoming startup that has
created a new operating system, StephanOS. It serves as the main operating
system for many computers.</p>
</div>
</div>
</div>
</body>
</html>
```

The responsiveness can be enhanced further by applying following options:

- Images to be handled as % rather than px.
- Utilizing @media to div tags and images as per different screens.
- Utilizing source types for images to handle responsiveness.
- Apply fluid grid to create Websites that could adapt to different screen sizes and devices.
- Typography should be defined within site. The primary goal is to ensure that the text remains legible and readable on screens of all sizes. For instance, the font size has to be changed based on parent container width.

15.8 Third Party Emulators for Testing Mobile Sites

After developing a mobile site, it is essential to test it before actual deployment. Testing is essential as the user expects seamless and efficient experiences from these apps. Suppose, the user installs an app but finds that the app is buggy, slow, or challenging to use, there is a high probability that the user can uninstall the app. This creates a bad experience for the user and a bad reputation for the developer. It is, therefore, necessary to simulate and test the app/site thoroughly utilizing third-party emulators.

Emulators are programs that allows to identify and resolve any issues that may arise when accessed from different devices. Some of the most popular ones include Google Chrome DevTools, BrowserStack, Genymotion, and so on.

15.9 Browser Developer Tools

Each modern Web browser has comprehensive developer tools that offer a wide range of functions, including the ability to evaluate the HTML, CSS, and JavaScript currently loaded on a Web page. In case of errors in the code, the browsers show the errors and location of errors in the code too. Console outputs can be seen in the browser. Thus, they provide insight into potential areas for optimization. Two such browsers are discussed as follows:

- Chrome Developer Tools
- Firefox Developer Tools

15.9.1 Chrome Developer Tools

Chrome Developer Tools is a set of Web developer tools built into the Google Chrome Web browser. It provides a range of features for Web developers such as debugging and editing that helps improve the performance and functionality of Web applications. Consider an existing mobile site. Steps to view the output of a mobile Website in a browser emulator are as follows:

Step 1 – Open the site in Chrome browser as shown in Figure 15.11.

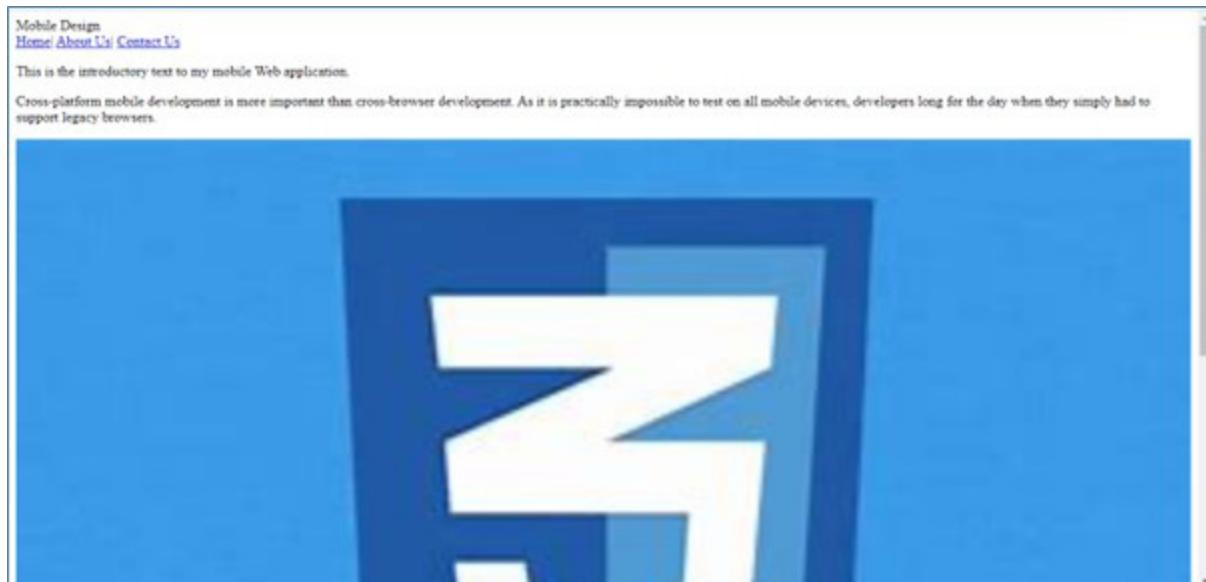


Figure 15.11: Mobile Website

Step 2 – Open the developer tools in Chrome by pressing F12, so a screen as shown in Figure 15.12 opens.

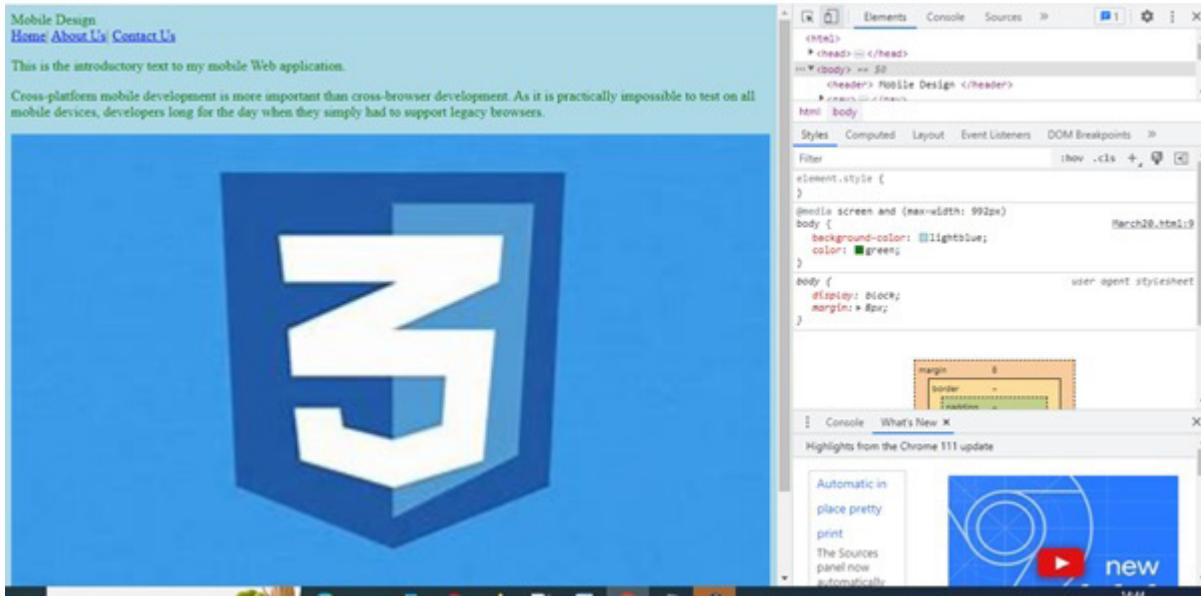


Figure 15.12: Chrome Developer Window

Step 3 – From the top right screen, click **Toggle device toolbar** as shown in Figure 15.13.

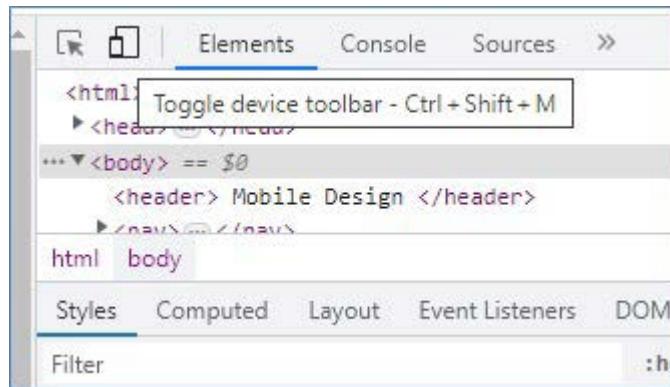


Figure 15.13: Toggle Device Toolbar

Step 4 – When clicked, a window as shown in Figure 15.14 is obtained.



Figure 15.14: Output Display Window

Step 5 – From the drop-down at the top, select any specific type of device to see the output. This gives the experience of the developed site looks on various devices.

15.9.2 Firefox Developer Tools

Firefox Developer Tools can be utilized to check and debug the HTML, CSS, and JavaScript code.

Step 1 – Open the Website on Firefox browser as shown in Figure 15.15.

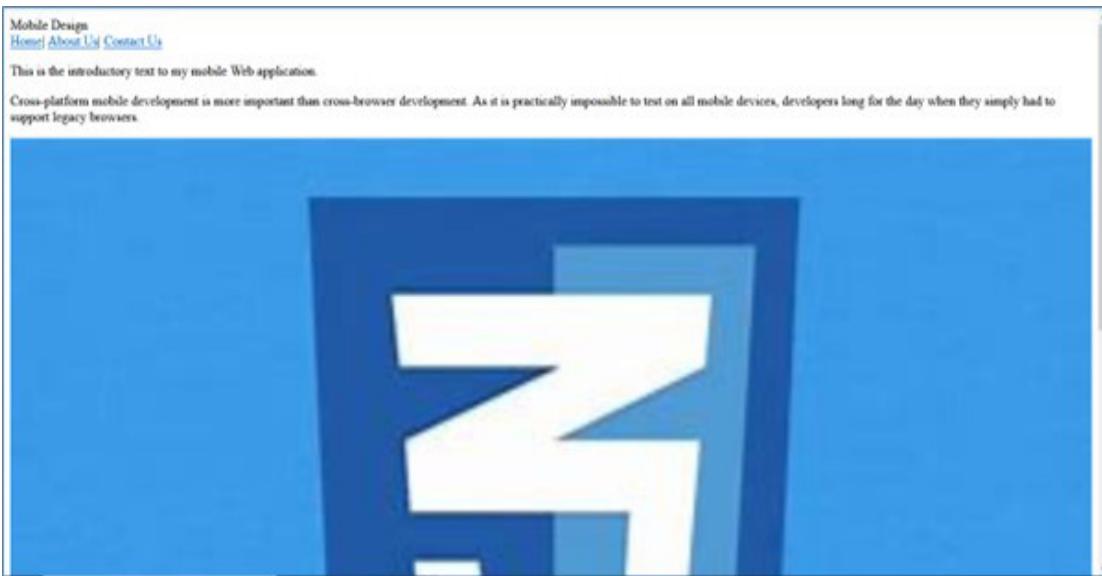


Figure 15.15: Demo Mobile Website

Step 2 – Press F12 to get the screen as shown in Figure 15.16.

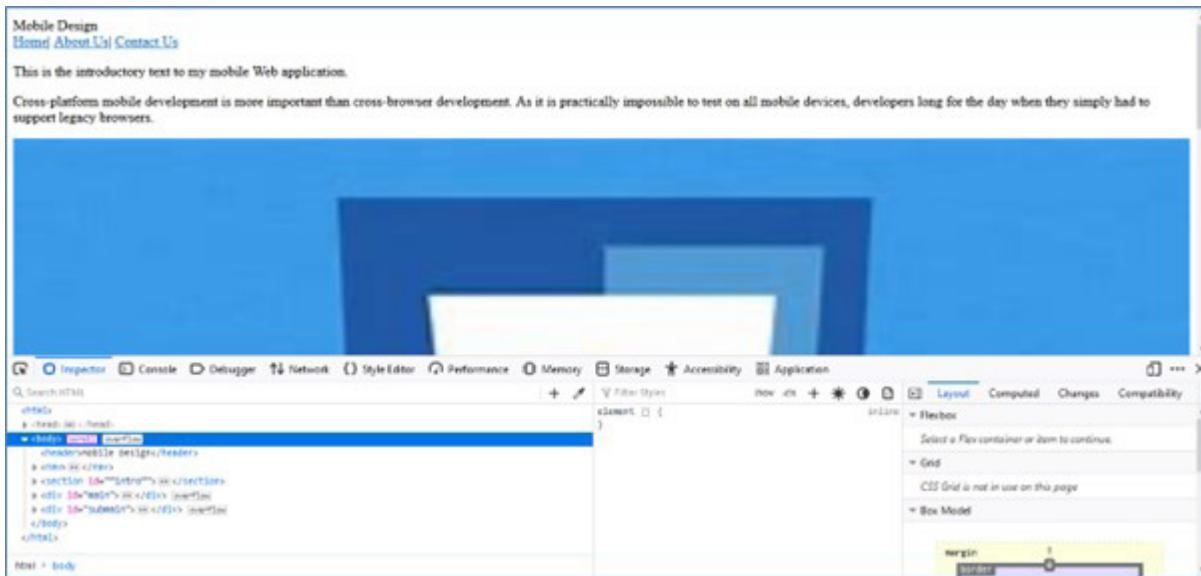


Figure 15.16: Firefox Developer Window

Step 3 – From bottom right, select **Responsive Design Mode** option as shown in Figure 15.17.

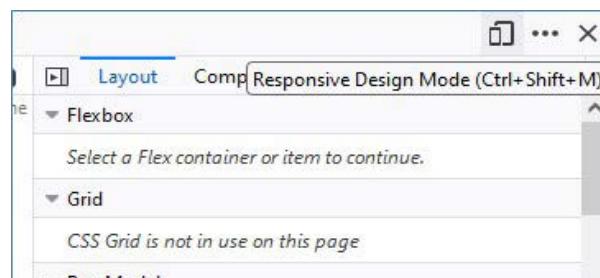


Figure 15.17: Responsive Design Mode

Step 4 – The screen as shown in Figure 15.18 is obtained.

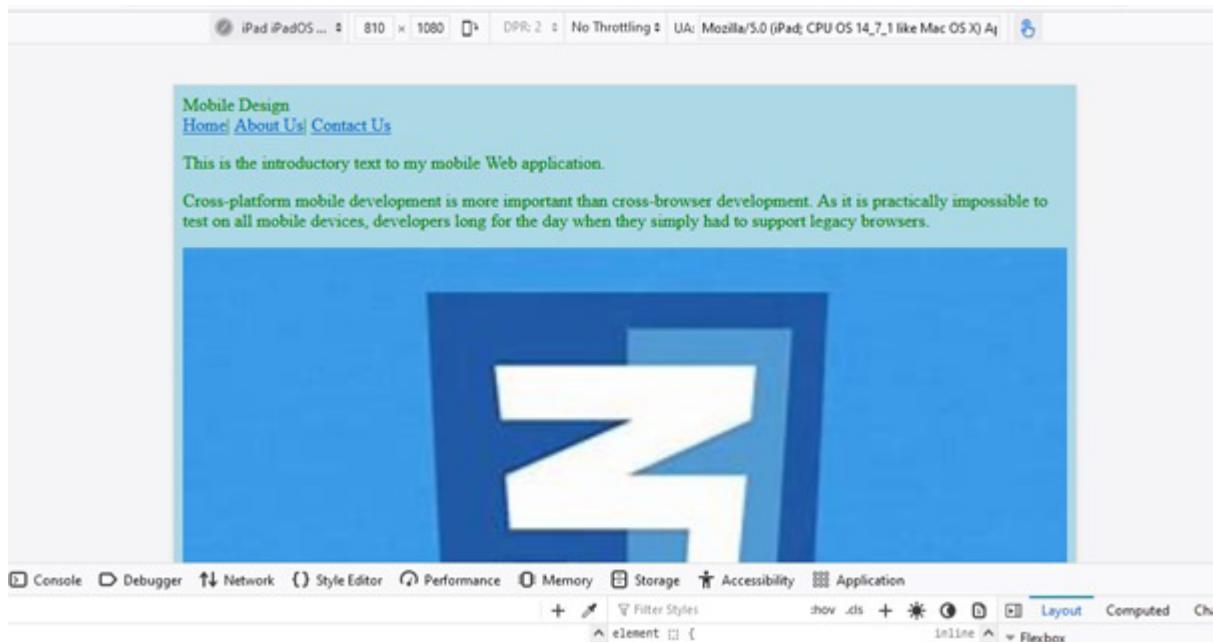


Figure 15.18: Output Display Window

Step 5 – From top, select specific type of mobile device to view the Website.

Overall, having a responsive Website has become an important aspect of Website design and development, as it ensures that the Website gives optimum performance regardless of the device they are accessing it from.

15.10 Check Your Progress

1. Identify the correct statement about HTML5 frameworks for mobile development.

(A)	HTML5 frameworks are only useful for developing Websites for desktop computers.	(C)	HTML5 frameworks can only be used for developing native mobile apps.
(B)	HTML5 frameworks provide pre-built components and templates to help streamline the mobile development process.	(D)	HTML5 frameworks are not recommended for mobile development.

2. What is the backbone of any Website?

(A)	CSS	(C)	JavaScript
(B)	HTML	(D)	PHP

3. What platform adds styling to the HTML elements?

(A)	ML	(C)	CSS
(B)	JavaScript	(D)	PHP

4. How does responsive typography feature make the Web page responsive?

(A)	It allows for more precise control over font size.	(C)	It keeps the font size same across all devices.
(B)	It allows the font size to adjust based on the screen size and device.	(D)	The line height is adjusted based on the screen size and device.

5. Identify the attribute that adjusts the layout and design of a Website for different devices.

(A)	Media Queries	(C)	Accessibility
(B)	Responsive images	(D)	Testing

15.10.1 Answers

1.	B
2.	B
3.	C
4.	B and D
5.	A

Summary

- The trend of viewing Websites on mobile screens has been on the rise making it essential to create responsive Web pages.
- Framework7, Ionic, and Bootstrap are some of the HTML5 frameworks to develop mobile apps.
- The main goal of responsive Web design is to create a flexible and user-friendly Website that can be accessed from any device of any size and orientation.
- CSS applies style to the HTML elements.
- The mobile-first design is preferred approach to designing Web pages.
- Emulators are programs that allows to identify and resolve any issues that arises when accessed from different devices.
- Firefox Developer tools and Chrome Developer Tools provide a range of features for Web developers such as debugging and editing.

Try It Yourself

1. Make a Web page that adapts to the screen size of the viewer device. By including the viewport meta tag in the head section of HTML document by utilizing HTML5 responsiveness. To ensure that the page width matches the device width, set the width property to device-width. Then, define several styles for various screen sizes using CSS media queries. For smaller screens, try increasing the text size or alter the layout so that elements stack vertically. Observe the Website on various devices with various screen sizes to check the responsiveness.



Session - 16

Mini Project

Welcome to the Session, **JavaScript - II**.

This session demonstrates the use of HTML5, CSS, and JavaScript in a real-world application (mini project) based on a case study.

In this Session, you will learn to:

- ➔ Explain the use of HTML5, CSS, and JavaScript in a real-world application

16.1 Introduction

In this session, you will view a step by step explanation to create a Website based on a case study. The Website will be created using HTML5, CSS, and JavaScript.

16.1.1 *Background and Necessity for the Website*

You want to start an e-Commerce bookstore to sell books related to latest trends in Information Technology online as the market is emerging. Books would then be purchased by various sections of people such as students, teachers, professors, and self-paced learners.

You decide to build a simple e-Commerce portal with the name BookParadise, using HTML, CSS, and JavaScript keeping in mind budget constraints. For the code editor, you decide to use CoffeeCup HTML Editor, which is freely available.

16.2 Scope of the Project

The Website will be simple and appealing. The Website will include following four pages:

- Home
- Products
- About Us
- Contact Us

A basic form will be included in the Contact Us page. The Home page will have a brief introduction on BookParadise, a section that displays category of books and a Featured Products section.

Clicking a featured product will display a pop-up to show price.

16.3 Implementation

A step by step guided approach to create the Website now follows.

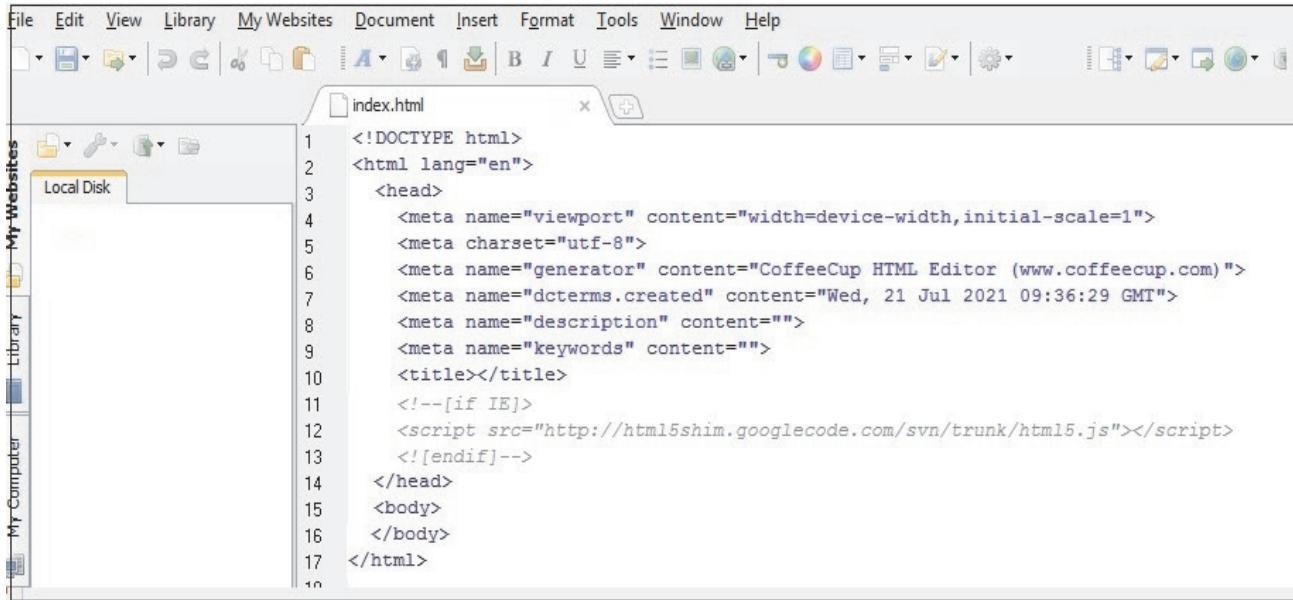
Step 1: Create the working folder

Create a folder called **BookParadise** in your local machine to save all the files related to the project.

Then, create two sub folders namely, **Images** and **Styles**, to save images and CSS file respectively. All the images for the Website will be saved in the **Images** folder.

Step 2: Create an index.html file and set up fonts and styles

Open the CoffeeCup editor and save the file as **index.html**. Figure 16.1 shows the default auto-generated code in **index.html** file.



```
<!DOCTYPE html>
<html lang="en">
<head>
<meta name="viewport" content="width=device-width,initial-scale=1">
<meta charset="utf-8">
<meta name="generator" content="CoffeeCup HTML Editor (www.coffeecup.com)">
<meta name="dcterms.created" content="Wed, 21 Jul 2021 09:36:29 GMT">
<meta name="description" content="">
<meta name="keywords" content="">
<title></title>
<!--[if IE]>
<script src="http://html5shim.googlecode.com/svn/trunk/html5.js"></script>
<![endif]-->
</head>
<body>
</body>
</html>
```

Figure 16.1: index.html File

Insert a CSS file in the markup. To do so:

- a. Click **File → New CSS**.
- b. Save as **style.css** in the **Styles** folder. Code for the styles will be added later.
- c. Return to the HTML markup. Add the partial statement `<link rel="stylesheet"`
- d. Click **Insert → Quick Link To Open Document**, select **style.css**, and edit the code to remove the anchor tags. Alternatively, manually add the code to link to the stylesheet as follows:
`<link rel="stylesheet" href="styles/style.css" />`

The next action will be to insert additional fonts to make text appealing. To do so:

- a. Click **Insert → Insert Google Fonts**. Select the Raleway font. Figure 16.2 shows the selected styles in the Raleway font.

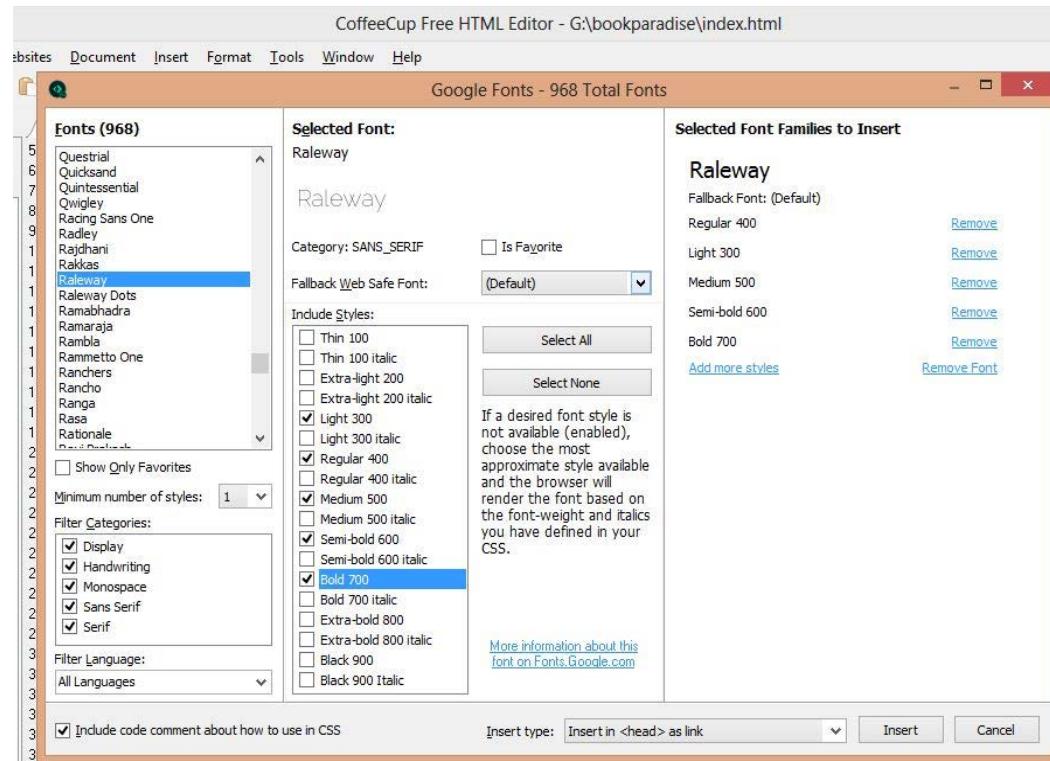


Figure 16.2: Selected Styles in Raleway Font

b. Click **Insert in <head> as link** option.

This will result in the code shown in Code Snippet 1.

Code Snippet 1:

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8" >
    <meta http-equiv="X-UA-Compatible" content="IE=edge" >
    <meta name="viewport" content="width=device-width, initial-scale=1.0" >
    <link rel="stylesheet" href="styles/style.css" />
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/
font-awesome/4.7.0/css/font-awesome.css" />
    <title>BookParadise Website</title>
    <link href="https://fonts.googleapis.com/css2?family=
=Raleway:ital,wght@0,300;0,400;0,500;0,700;1,600&display=swap"
        rel = "stylesheet" >
</head>
<body>
</body>
</html>
```

Step 3: Add the code to create navigation bar

The navigation bar includes logo, Home page, Products page, About Us page, and Contact Us page. Code Snippet 2 shows the code for navigation bar. Add this code after the body tag.

Code Snippet 2:

```
<div class="header">
    <div class="container">
        <!--Start Navbar-->
        <div class="navbar">
            <div class="logo">
                <a href="index.html" class="logo-red">BookParadise</a>
            </div>
            <nav>
                <ul>
                    <li><a href="index.html">Home</a></li>
                    <li><a href="product.html">Products</a></li>
                    <li><a href="about.html">About Us</a></li>
                    <li><a href="contact.html">Contact Us</a></li>
                </ul>
            </nav>
        </div>
    <!--End Navbar-->
```

Step 4: Add the code to create banner

Code Snippet 3 shows the code for banner. Note the banner will have a description and an image. Add the code from **line 31** in **index.html**.

Code Snippet 3:

```
<!--Start Banner-->
<div class="row">
    <div class="col-2">
        <h1>Explore BookParadise here</h1>
        <p>We have a huge collection of books in information technology. BookParadise offers all books at fair price and extends customer satisfaction by providing user-friendly search engine, easy payment options, and quicker delivery systems. We provide exciting offers and discounts on our books. BookParadise is also looking to partner with all the sellers around the country.</p>
```

We have an affiliate program that pays a 10% commission on every sale. Anyone can join the program and be rewarded for advocacy of books. BookParadise wants to give back to everyone who promotes books, authors, and independent bookstores!

We give away over 65% of our profit margin to stores, and authors who make up the inspirational culture around books!

```
</p>
    <a href="product.html" class="btn">Explore Now &#10137;</a>
</div>
<div class="col-2">
    
</div>
</div>
</div>
</div>
<!--End Banner-->
```

Step 5: Add the code to create categories and featured products section

Code Snippet 4 shows the code for the categories section. Add this code at **line 48** onwards in **index.html**.

Code Snippet 4:

```
<!--Start Category-->
<div class="categories">
    <div class="small-container">
        <div class="row">
            <div class="col-3">
                
            </div>
            <div class="col-3">
                
            </div>
            <div class="col-3">
                
            </div>
        </div>
    </div>
</div>
<!--End Category-->
```

Code Snippet 5 shows the code for the Featured Products section. This will show the name, rating, and price of each product. Note that a modal feature is added for the pop-up functionality. Clicking an image in the featured section displays a pop-up that shows attributes of a book, such as category and price and so on. Add this code in **index.html** from **line 65** onwards.

Code Snippet 5:

```
<!-----Start Featured Products----->
<div class="featured">
  <div class="small-container">
    <h2 class="title">Featured Products</h2>
    <div class="row" id="product-list">
      <div class="col-4" data-target="#modal1">
        
        <h4 class="product-name">HTML</h4>
        <div class="rating">
          <i class="fa fa-star"></i>
          <i class="fa fa-star"></i>
          <i class="fa fa-star"></i>
          <i class="fa fa-star"></i>
          <i class="fa fa-star-o"></i>
        </div>
        <p>$80.00</p>
      </div>
      <div class="col-4" data-target="#modal2">
        
        <h4 class="product-name">CSS</h4>
        <div class="rating">
          <i class="fa fa-star"></i>
          <i class="fa fa-star"></i>
          <i class="fa fa-star"></i>
          <i class="fa fa-star"></i>
          <i class="fa fa-star-o"></i>
        </div>
        <p>$30.00</p>
      </div>
      <div class="col-4" data-target="#modal3">
        
        <h4 class="product-name">JavaScript</h4>
        <div class="rating">
          <i class="fa fa-star"></i>
          <i class="fa fa-star"></i>
          <i class="fa fa-star"></i>
          <i class="fa fa-star"></i>
          <i class="fa fa-star-half-o"></i>
        </div>
      </div>
    </div>
  </div>
</div>
```

```
</div>
<p>$20.00</p>
</div>
<div class="col-4" data-target="#modal4">
    
    <h4 class="product-name">Angular</h4>
    <div class="rating">
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star-half-o"></i>
    </div>
    <p>$50.00</p>
</div>
<div class="col-4" data-target="#modal5">
    
    <h4 class="product-name">Learning Programming Techniques</h4>
    <div class="rating">
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star-half-o"></i>
    </div>
    <p>$110.00</p>
</div>
<div class="col-4" data-target="#modal6">
    
    <h4 class="product-name">Improving Productivity</h4>
    <div class="rating">
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star-half-o"></i>
    </div>
    <p>$35.00</p>
```

```
</div>
<div class="col-4" data-target="#modal17">
    
    <h4 class="product-name">Modern Programming</h4>
    <div class="rating">
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star-half-o"></i>
    </div>
    <p>$95.00</p>
</div>
<div class="col-4" data-target="#modal18">
    
    <h4 class="product-name">Mindful Learning</h4>
    <div class="rating">
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star-half-o"></i>
    </div>
    <p>$150.00</p>
</div>
</div>
</div>
<!-------End Featured Products----->
```

Ensure to add code for all the products you want to display in the Featured Products section.

Step 6: Add the code for footer

Next, we design the footer. Code Snippet 6 shows the code for the Footer section. Add this code from **line 170** onwards in **index.html**.

Code Snippet 6:

```
<!-----Start Footer----->
<div class="footer">
    <div class="container">
        <div class="row">
            <div class="footer-col-1">
                <a href="index.html" class="logo-white">BookParadise</a>
            </div>
            <div class="footer-col-2">
                <a href="index.html" class="logo-white">BookParadise</a>
                <p>Your One Stop Shop for all your book requirements</p>
            </div>
            <div class="footer-col-4">
                <h3>Follow Us</h3>
                <ul>
                    <li>Facebook</li>
                    <li>Twitter</li>
                    <li>Instagram</li>
                    <li>Youtube</li>
                </ul>
            </div>
        </div>
        <hr>
        <p class="copyright">Copyright 2023 - BookParadise</p>
    </div>
</div>
<!-----End Footer----->
```

Step 7: Add the code for Modal (pop-up)

Code Snippet 7 shows the code for the modal. Add this code from **line 196** onwards in **index.html**.

Code Snippet 7:

```
<!-----Start Modal----->
<div class="modal" id="modal1">
    <div class="single-item">
        <div class="small-container">
            <div class="modal-header">
                <button class="close-modal">&times;</button>
            </div>
    </div>
```

```
<div class="row">
    <div class="col-2">
        
    </div>
    <div class="col-2">
        <p>Home / Books</p>
        <h1>HTML</h1>
        <h4>Price: $80</h4>
        <h4>Quantity: </h4>
        <select>
            <option>1</option>
            <option>2</option>
            <option>3</option>
            <option>4</option>
            <option>5</option>
        </select>
        <br>
        <a href="" class="btn">Add To Cart</a>
    </div>
</div>
</div>
</div>
<div class="modal" id="modal2">
    <div class="single-item">
        <div class="small-container">
            <div class="modal-header">
                <button class="close-modal">&times;</button>
            </div>
            <div class="row">
                <div class="col-2">
                    
                </div>
                <div class="col-2">
                    <p>Home / Books</p>
                    <h1>CSS</h1>
                    <h4>Price: $30</h4>
                    <h4>Quantity: </h4>
                    <select>
```

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```
<div class="col-2">
    
</div>
<div class="col-2">
    <p>Home / Books</p>
    <h1>Angular</h1>
    <h4>Price: $50</h4>
    <h4>Quantity: </h4>
    <select>
        <option>1</option>
        <option>2</option>
        <option>3</option>
        <option>4</option>
        <option>5</option>
    </select>
    <br>
    <a href="" class="btn">Add To Cart</a>
</div>
</div>
</div>
<div class="modal" id="modal5">
    <div class="single-item">
        <div class="small-container">
            <div class="modal-header">
                <button class="close-modal">&times;</button>
            </div>
            <div class="row row-2">
                <div class="col-2">
                    
                </div>
                <div class="col-2">
                    <p>Home / Books</p>
                    <h1>Learning Programming Techniques 110</h1>
                    <h4>Price: $110</h4>
                    <h4>Quantity: </h4>
                    <select>
                        <option>1</option>
                        <option>2</option>
                        <option>3</option>
                        <option>4</option>
                        <option>5</option>
                    </select>
                    <br>
                    <a href="" class="btn">Add To Cart</a>
                </div>
            </div>
        </div>
    </div>
</div>
```

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```
</div>
</div>

<div class="modal" id="modal6">
  <div class="single-item">
    <div class="small-container">
      <div class="modal-header">
        <button class="close-modal">&times;</button>
      </div>
      <div class="row row2">
        <div class="col-2">
          
        </div>
        <div class="col-2">
          <p>Home / Books</p>
          <h1>Improving Productivity</h1>
          <h4>Price: $35</h4>
          <h4>Quantity: </h4>
          <select>
            <option>1</option>
            <option>2</option>
            <option>3</option>
            <option>4</option>
            <option>5</option>
          </select>
          <br>
          <a href="" class="btn">Add To Cart</a>
        </div>
      </div>
    </div>
  </div>
</div>

<div class="modal" id="modal7">
  <div class="single-item">
    <div class="small-container">
      <div class="modal-header">
        <button class="close-modal">&times;</button>
      </div>
      <div class="row row2">
        <div class="col-2">
          
        </div>
      </div>
    </div>
  </div>
</div>
```

```
<div class="col-2">
    <p>Home / Books</p>
    <h1>Modern Programming</h1>
    <h4>Price: $95</h4>
    <h4>Quantity: </h4>
    <select>
        <option>1</option>
        <option>2</option>
        <option>3</option>
        <option>4</option>
        <option>5</option>
    </select>
    <br>
    <a href="" class="btn">Add To Cart</a>
</div>
</div>
</div>
</div>
</div>
</div>
</div>
<div class="modal" id="modal8">
    <div class="single-item">
        <div class="small-container">
            <div class="modal-header">
                <button class="close-modal">&times;</button>
            </div>
            <div class="row row2">
                <div class="col-2">
                    
                </div>
                <div class="col-2">
                    <p>Home / Books</p>
                    <h1>Mindful Learning</h1>
                    <h4>Price: $150</h4>
                    <h4>Quantity: </h4>
                    <select>
                        <option>1</option>
                        <option>2</option>
                    </select>
                    <br>
                    <a href="" class="btn">Add To Cart</a>
                </div>
            </div>
        </div>
    </div>
</div>
```

```
</div>
    </div>
</div>
</div>
</div>
<div id="overlay"></div>
<!-------End Modal----->
```

Ensure to add the modal code for all the products displayed in the Featured Products section, for which you want to show product details.

Step 8: Include .js file

For now, add a link to the external JavaScript file, **main.js**, in the index file.

Code Snippet 8 shows the code to add a reference to **main.js**. Add this code from **line 432** onwards in **index.html** after the closing body tag `</body>`.

Code Snippet 8:

```
<!-------JavaScript----->
<script src="main.js"></script>
</html>
```

Step 9: Style all elements

Code Snippet 9 shows the CSS for navigation bar. Add this code in **styles/style.css** from **line 1** onwards.

Code Snippet 9:

```
/* Navbar css*/
{
    margin: 0;
    padding: 0%;
    box-sizing: border-box;
    font-family: 'Raleway', sans-serif;
}
/* Start Navbar css*/
.navbar{
    display: flex;
    align-items: center;
    padding: 20px;
}
nav{
    flex: 1;
```

```
    text-align: right;
}
nav ul{
    display: inline-block;
    list-style-type: none;
}
nav ul li{
    display: inline-block;
    margin-right: 20px;
}
a{
    text-decoration: none;
    color: #555;
}
/* End Navbar css*/
```

Banner

Code Snippet 10 shows the CSS for banner. Add this code in styles/style.css from **line 32** onwards.

Code Snippet 10:

```
/* Banner css*/
p{
    color: #555;
}
.container{
    max-width: 1300px;
    margin: auto;
    padding-left: 25px;
    padding-left: 25px;
}
.row{
    display: flex;
    align-items: center;
    flex-wrap: wrap;
    justify-content: space-around;
    margin-bottom: 60px;
}
.col-2 {
    flex-basis: 50%;
```

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```
    min-width: 300px;
}
.col-2 img{
    max-width: 100%;
    padding: 50px 50px;
}
.col-2 h1{
    font-size: 50px;
    line-height: 60px;
    margin: 25px 0px;
}
.btn, .sortbtn{
    display: inline-block;
    background-color: #ff523b;
    color: #fff;
    padding: 8px 30px;
    margin: 30px 0px;
    border-radius: 30px;
    transition: background-color 0.5s ;
}
.btn:hover{
    background-color: #563434;
}
.sortbtn{
    border: none;
    cursor: pointer;
}
.header{
background-color: #f2f2f2;
}
.header .row{
    margin-top: 70px;
}
/* End Banner css*/
```

Category

Code Snippet 11 shows the CSS for the category section. Add this code in **styles/style.css** from **line 85** onwards.

Code Snippet 11:

```
/* Categories css*/
.categories{
    margin: 70px 0px;
}

.col-3{
    flex-basis: 30%;
    min-width: 250px;
    margin-bottom: 30px;
}

.col-3 img{
    width: 100%;
}

.small-container{
max-width: 1080px;
    margin: auto;
    padding-left: 25px;
    padding-right: 25px;
}

/* End Categories css/
```

Featured Category

Code Snippet 12 shows the CSS for featured section. Add this code in **styles/style.css** from **line 104** onwards.

Code Snippet 12:

```
/* Featured css*/
.featured{
    margin-bottom: 80px;
}

.col-4 {
    flex-basis: 23%;
    padding: 10px;
    cursor: pointer;
    min-width: 200px;
    margin-bottom: 50px;
    margin: 6px;
    background: #f2f2f2;
    transition: transform 0.5s;
}
```

```
.col-4 img{  
    width: 100%;  
}  
.title{  
    text-align: center;  
    margin: 0 auto 80px;  
    position: relative;  
    line-height: 60px;  
    color: #555;  
}  
.title:after{  
    content: '';  
    background-color: #ff523b;  
    width: 80px;  
    height: 5px;  
    border-radius: 5px;  
    position: absolute;  
    bottom: 0;  
    left: 50%;  
    transform: translateX(-50%);  
}  
h4{  
    color: #555;  
    font-weight: normal;  
    margin-bottom: 10px;  
}  
.col-4 p{  
    font-size: 14px;  
}  
.rating .fa{  
    color: orange;  
}  
.col-4:hover{  
    transform: translateY(-5px);  
}  
/* End Featured css*/
```

Footer

Code Snippet 13 shows CSS for footer. Add this code in **styles/style.css** from **line 154** onwards.

Code Snippet 13:

```
/* Footer css */
.footer{
    background: #000;
    color: #8a8a8a;
    font-size: 14px;
    padding: 60px 0 20px;
}
.footer p {
    color: #8a8a8a;
}
.footer h3{
    color: #fff;
    margin-bottom: 20px;
}
.footer-col-1, .footer-col-2, .footer-col-3, .footer-col-4{
    min-width: 250px;
    margin-bottom: 20px;
}
.footer-col-1{
    flex-basis: 30%;
}
.footer-col-2{
    flex: 1;
    text-align: center;
}
.footer-col-2 img{
    width: 180px;
    margin-bottom: 20px;
}
.footer-col-3, .footer-col-4{
    flex-basis: 12%;
    text-align: center;
}
ul{
    list-style-type: none;
}
.app-logo{
margin-top: 20px;
}
.app-logo img{
```

```
        width: 140px;
    }
.footer hr{
    border: none;
    background: #b5b5b5;
    height: 1px;
    margin: 20px 0px;
}
.copyright{
    text-align: center;
}
/* End Footer css*/
```

Modal

Code Snippet 14 shows the CSS for modal. Add this code in **styles/style.css** from **line 206** onwards.

Code Snippet 14:

```
/* Modal css */
.close-modal {
    background: none;
    color: black;
    border: none;
    font-size: 3.5rem;
    cursor: pointer;
}
.modal {
    position: fixed;
    top: -50%;
    left: 50%;
    transform: translate(-50%, -50%);
    transition: top 0.3s ease-in-out;
    border: 1px solid #ccc;
    border-radius: 10px;
    z-index: 2;
    background-color: #fff;
}
.modal.active {
    top: 50%;
}
.modal-header {
```

```
        display: flex;
        flex-direction: row-reverse;
    }
.modal .body {
    padding: 0.75rem;
}
/* End Modal css */
```

Overlay

Code Snippet 15 shows the CSS for overlay. Add this code in **styles/style.css** from **line 236** onwards.

Code Snippet 15:

```
#overlay {
    display: none;
    position: fixed;
    top: 0;
    left: 0;
    width: 100%;
    height: 100%;
    background-color: rgba(0, 0, 0, 0.3);
}
#overlay.active {
    display: block;
}
```

Save the style.css file and close it.

Step 10: Add JavaScript query for modal

Create a new JavaScript file using CoffeeCup HTML5 Editor by clicking **File → New JavaScript Page**. Name the file as **main.js**.

Code Snippet 16 shows the code to add the JavaScript code for modals. Add this code in the **main.js** file from **line 1** onwards.

Code Snippet 16:

```
const btns = document.querySelectorAll("[data-target]");
const close_modals = document.querySelectorAll(".close-modal");
const overlay = document.getElementById("overlay");
// For opening popup
btns.forEach((btn) => {
    btn.addEventListener("click", () => {
        document.querySelector(btn.dataset.target).classList.add("active");
```

```
    overlay.classList.add("active");
  });
}

//For closing popup using "X" sign
close_modals.forEach((btn) => {
  btn.addEventListener("click", () => { const modal = btn.closest(".modal");
  modal.classList.remove("active");
  overlay.classList.remove("active");
  });
});

//After opening popup, if you click outside the popup, it will close.
window.onclick = (event) => {
  if (event.target == overlay) {
    const modals = document.querySelectorAll(".modal");
    modals.forEach((modal) => modal.classList.remove("active"));
    overlay.classList.remove("active");
  }
};
```

Step 11: Create the About Us Page

1. Create an **about.html file** similar to the way **index.html** was created.
2. Include the links for style sheet and fonts.
3. Give the title as BookParadise Website - About Us.
4. Add the navigation bar.
5. Add the content for the About Us page.

Code Snippet 17 shows the code to add the content for the About Us page.

Code Snippet 17:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <link rel="stylesheet" href="styles/style.css" />
  <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.css" />
  <title>BookParadise Website - About Us</title>
```

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```
<link href="https://fonts.googleapis.com/
css?family=Raleway:ital,wght@0,300;0,400;0,500;0,700;1,600&display=swap"
      rel="stylesheet">

</head>
<body>

    <!--Start Header-->
    <div class="header">
        <div class="container">
            <!--Start Navbar-->
            <div class="navbar">
                <div class="logo">
                    <a href="index.html" class="logo-red">BookParadise</a>
                </div>
                <nav>
                    <ul>
                        <li><a href="index.html">Home</a></li>
                        <li><a href="product.html">Products</a></li>
                        <li><a href="about.html">About Us</a></li>
                        <li><a href="contact.html">Contact Us</a></li>
                    </ul>
                </nav>
            </div>
            <!--End Navbar-->
        </div>
    </div>
    <!--End Header-->
    <!--Start About Us content-->
    <div class="single-product">
        <div class="small-container">
            <div class="row">
                <h2 class="title">About BookParadise</h2>
                <p>We have a huge collection of books in information technology. BookParadise offers all books at fair price and extends customer satisfaction by providing user-friendly search engine, easy payment options, and quicker delivery systems. We provide exciting offers and discounts on our books. BookParadise is also looking to partner with all the sellers around the country. We have an affiliate program that pays a 10% commission on every sale. Anyone can join the program and be rewarded for advocacy of books.

```

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```
BookParadise wants to give back to everyone who promotes books, authors, and
independent bookstores!
We give away over 65% of our profit margin to stores, and authors who make
up the inspirational culture around books!    </p>
    </div>
    </div>
    </div>
<!--End About Us content-->
<!--Start Footer-->
<div class="footer">
    <div class="container">
        <div class="row">
            <div class="footer-col-1">
                <a href="index.html" class="logo-white">BookParadise</a>
            </div>
            <div class="footer-col-2">
                <a href="index.html" class="logo-white">BookParadise</a>
                <p>Your One Stop Shop for all your book s</p>
            </div>
            <div class="footer-col-4">
                <h3>Follow Us</h3>
                <ul>
                    <li>Facebook</li>
                    <li>Twitter</li>
                    <li>Instagram</li>
                    <li>Youtube</li>
                </ul>
            </div>
        </div>
        <hr>
        <p class="copyright">Copyright 2023 - BookParadise</p>
    </div>
</div>
<!--End Footer-->
</body>
</html>
```

Step 12: Create the Contact Us Page

Create the **contact.html** file and include code for linking CSS, font, navigation bar, and footer section. Add the code for the Contact Us form as shown in Code Snippet 18. Include **main.js** as the form will be validated using JavaScript.

Code Snippet 18:

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <link rel="stylesheet" href="styles/style.css" />
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/
font-awesome/4.7.0/css/font-awesome.css" />
    <title>BookParadise Website - Contact Us</title>
    <link href="https://fonts.googleapis.com/css2?family=
Raleway:ital,wght@0,300;0,400;0,500;0,700;1,600&display=swap" rel=
"stylesheet">
  </head>
  <body>
    <!--Start Header-->
    <div class="header">
      <div class="container">
        <!--Start Navbar-->
        <div class="navbar">
          <div class="logo">
            <a href="index.html" class="logo-red">BookParadise</a>
          </div>
          <nav>
            <ul>
              <li><a href="index.html">Home</a></li>
              <li><a href="product.html">Products</a></li>
              <li><a href="about.html">About Us</a></li>
              <li><a href="contact.html">Contact Us</a></li>
            </ul>
          </nav>
        </div>
        <!--End Navbar-->
      </div>
    </div>
    <!--Start Contact Us Form-->
    <div class="wrapper">
      <h2 class="title">Contact Us</h2>
      <div class="contact">
```

```
<div id="error_message">
</div>
<form action="" id="myform" onsubmit="return validate();">
    <div class="input_field">
        <input type="text" placeholder="Name" id="name">
    </div>
    <div class="input_field">
        <input type="text" placeholder="Subject" id="subject">
    </div>
    <div class="input_field">
        <input type="text" placeholder="Phone" id="phone">
    </div>
    <div class="input_field">
        <input type="text" placeholder="Email" id="email">
    </div>
    <div class="input_field">
        <textarea placeholder="Message" id="message"></textarea>
    </div>
    <div class="submitbtn">
        <input type="submit">
    </div>
</form>
</div>
<!--End Contact Us Form-->
<!--Start Footer-->
<div class="container">
    <div class="row">
        <div class="footer-col-1">
            <a href="index.html" class="logo-white">BookParadise</a>
        </div>
        <div class="footer-col-2">
            <a href="index.html" class="logo-white">BookParadise</a>
            <p>Your One Stop Shop for all your book requirements</p>
        </div>
        <div class="footer-col-4">
            <h3>Follow Us</h3>
            <ul>
                <li>Facebook</li>
```

```
<li>Twitter</li>
<li>Instagram</li>
<li>Youtube</li>
</ul>
</div>
</div>
<hr>
<p class="copyright">Copyright 2023 - BookParadise</p>
</div>
</div>
<!--End Footer-->
</body>
<!--JavaScript-->
<script src="main.js"></script>
</html>
```

Validation

Add the JavaScript code shown in Code Snippet 19 in the **main.js** file from **line 26** onwards to validate the data entered in Contact Us page.

Code Snippet 19:

```
//Contact form validation
function validate() {
    var name = document.getElementById("name").value;
    var subject = document.getElementById("subject").value;
    var phone = document.getElementById("phone").value;
    var email = document.getElementById("email").value;
    var message = document.getElementById("message").value;
    var error_message = document.getElementById("error_message");
    error_message.style.padding = "10px";
    var text;
    // Asian names can be three-letter names such as Lee or Mae hence, limit >=3
    if (name.length < 2) {
        text = "Please Enter valid Name (Minimum 3 characters)";
        error_message.innerHTML = text;
        return false;
    }
    if (subject.length < 10) {
        text = "Please Enter Correct Subject (Minimum 10 characters)";
        error_message.innerHTML = text;
    }
}
```

```
        return false;
    }

    if (isNaN(phone) || phone.length != 10) {
        text = "Please Enter valid Phone Number (10-digit)";
        error_message.innerHTML = text;
        return false;
    }

    //Message should have more than 140 characters
    if (message.length <= 140) {
        text = "Please enter more than 140 Characters";
        error_message.innerHTML = text;
        return false;
    }

    //Message should have less than 500 characters
    if (message.length >= 500) {
        text = "Please enter less than 500 Characters";
        error_message.innerHTML = text;
        return false;
    }

    // This alert message will appear if all form fields are filled correctly
    alert("Form submitted successfully! Thank you for contacting us");
    return true;
}
```

Step 13: Create the Products Page

Create the **product.html** file and include CSS, font, navigation bar, and footer section. Include **main.js**. Add all the products and filters for searching and sorting them.

Code Snippet 20 shows the code to perform all these actions in **product.html**.

Code Snippet 20:

```
<!DOCTYPE html>
<html lang="en">
    <head>
        <meta charset="UTF-8">
        <meta http-equiv="X-UA-Compatible" content="IE=edge">
        <meta name="viewport" content="width=device-width, initial-scale=1.0">
        <link rel="stylesheet" href="styles/style.css" />
        <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/
font-awesome/4.7.0/css/font-awesome.css" />
    <title>BookParadise Website - All Products</title>
```

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```
<link href="https://fonts.googleapis.com/css2?family=Raleway:ital,wght@0,300;0,400;0,500;0,700;1,600&display=swap" rel="stylesheet">
</head>
<body>
    <div class="header">
        <div class="container">
            <!--Start Navbar-->
            <div class="navbar">
                <div class="logo">
                    <a href="index.html" class="logo-red">BookParadise</a>
                </div>
                <nav>
                    <ul>
                        <li><a href="index.html">Home</a></li>
                        <li><a href="product.html">Products</a></li>
                        <li><a href="about.html">About Us</a></li>
                        <li><a href="contact.html">Contact Us</a></li>
                    </ul>
                </nav>
            </div>
            <!--End Navbar-->
        </div>
    </div>
<!--End Header-->
<!--Start All Products-->
<div class="featured">
    <div class="small-container">
        <div class="row row-2">
            <h1>All Products</h1>
            <!--Search Filter-->
            <input id="search" onkeyup="filter()" type="text" placeholder="Search here">
            <!--Sort Filter-->
            <button onclick="sortList()" class="sortbtn">Sort By Price</button>
        </div>
        <div class="row" id="product-list">
            <div class="col-4" data-target="#modall1">
```

```

<h4 class="product-name">HTML</h4>
<div class="rating">
    <i class="fa fa-star"></i>
    <i class="fa fa-star"></i>
    <i class="fa fa-star"></i>
    <i class="fa fa-star"></i>
    <i class="fa fa-star-o"></i>
</div>
$<span class="price">80</span>
</div>
<div class="col-4" data-target="#modal2">
    
    <h4 class="product-name">CSS</h4>
    <div class="rating">
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star-o"></i>
    </div>
    $<span class="price">30</span>
    </div>
<div class="col-4" data-target="#modal3">
    
    <h4 class="product-name">JavaScript</h4>
    <div class="rating">
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star-half-o"></i>
    </div>
    $<span class="price">20</span>
    </div>
<div class="col-4" data-target="#modal4">
    
    <h4 class="product-name">Angular</h4>
    <div class="rating">
```

```
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star-half-o"></i>
    </div>
    $<span class="price">50</span>
</div>
<div class="col-4" data-target="#modal15">
    
    <h4 class="product-name">Learning Techniques</h4>
    <div class="rating">
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star-half-o"></i>
    </div>
    $<span class="price">110</span>
</div>
<div class="col-4" data-target="#modal16">
    
    <h4 class="product-name">Improving Productivity</h4>
    <div class="rating">
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star-half-o"></i>
    </div>
    $<span class="price">35</span>
</div>
<div class="col-4" data-target="#modal17">
    
    <h4 class="product-name">Modern Learning</h4>
    <div class="rating">
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
```

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```
        <i class="fa fa-star"></i>
        <i class="fa fa-star-half-o"></i>
    </div>
    $<span class="price">95</span>
</div>
<div class="col-4" data-target="#modal8">
    
    <h4 class="product-name">Mindful Learning</h4>
    <div class="rating">
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star"></i>
        <i class="fa fa-star-half-o"></i>
    </div>
    $<span class="price">150</span>
</div>
</div>
<div class="page-btn">
    <span>1</span>
    <span>2</span>
    <span>3</span>
    <span>4</span>
    <span>=➙</span>
</div>
</div>
<!-------End All Products----->
<!-------Start Footer----->
<div class="footer">
    <div class="container">
        <div class="row">
            <div class="footer-col-1">
                <a href="index.html" class="logo-white">BookParadise</a>
            </div>
            <div class="footer-col-2">
                <a href="index.html" class="logo-white">BookParadise</a>
                <p>Your One Stop Shop for all your book requirements</p>
            </div>
            <div class="footer-col-4">
```

```
<h3>Follow Us</h3>
<ul>
    <li>Facebook</li>
    <li>Twitter</li>
    <li>Instagram</li>
    <li>Youtube</li>
</ul>
</div>
</div>
<hr>
<p class="copyright">Copyright 2023 - BookParadise</p>
</div>
</div>
<!--End Footer-->
<!--Start Modal-->
<div class="modal" id="modall">
    <div class="single-item">
        <div class="small-container">
            <div class="modal-header">
                <button class="close-modal">&times;</button>
            </div>
            <div class="row">
                <div class="col-2">
                    
                </div>
                <div class="col-2">
                    <p>Home / Books</p>
                    <h1>HTML</h1>
                    <h4>Price: $80</h4>
                    <h4>Quantity: </h4>
                    <select>
                        <option>1</option>
                        <option>2</option>
                        <option>3</option>
                        <option>4</option>
                        <option>5</option>
                    </select>
                    <br>
                    <a href="" class="btn">Add To Cart</a>
                </div>
            </div>
        </div>
    </div>
</div>
```

```
</div>
</div>
</div>
<div class="modal" id="modal2">
    <div class="single-item">
        <div class="small-container">
            <div class="modal-header">
                <button class="close-modal">&times;</button>
            </div>
            <div class="row">
                <div class="col-2">
                    
                </div>
                <div class="col-2">
                    <p>Home / Books</p>
                    <h1>CSS</h1>
                    <h4>Price: $30</h4>
                    <h4>Quantity: </h4>
                    <select>
                        <option>1</option>
                        <option>2</option>
                        <option>3</option>
                        <option>4</option>
                        <option>5</option>
                    </select>
                    <br>
                    <a href="" class="btn">Add To Cart</a>
                </div>
            </div>
        </div>
    </div>
</div>
<div class="modal" id="modal3">
    <div class="single-item">
        <div class="small-container">
            <div class="modal-header">
                <button class="close-modal">&times;</button>
            </div>
            <div class="row">
                <div class="col-2">
```


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```
<div class="single-item">
  <div class="small-container">
    <div class="modal-header">
      <button class="close-modal">&times;</button>
    </div>
    <div class="row row2">
      <div class="col-2">
        
      </div>
      <div class="col-2">
        <p>Home / Books</p>
        <h1>Improving Productivity</h1>
        <h4>Price: $35</h4>
        <h4>Quantity: </h4>
        <select>
          <option>1</option>
          <option>2</option>
          <option>3</option>
          <option>4</option>
          <option>5</option>
        </select>
        <br>
        <a href="" class="btn">Add To Cart</a>
      </div>
    </div>
  </div>
</div>
<div class="modal" id="modal7">
  <div class="single-item">
    <div class="small-container">
      <div class="modal-header">
        <button class="close-modal">&times;</button>
      </div>
      <div class="row row2">
        <div class="col-2">
          
        </div>
```

```
<div class="col-2">
    <p>Home / Books</p>
    <h1>Modern Programming</h1>
    <h4>Price: $95</h4>
    <h4>Quantity: </h4>
    <select>
        <option>1</option>
        <option>2</option>
        <option>3</option>
        <option>4</option>
        <option>5</option>
    </select>
    <br>
    <a href="" class="btn">Add To Cart</a>
</div>
</div>
</div>
</div>
<div class="modal" id="modal8">
    <div class="single-item">
        <div class="small-container">
            <div class="modal-header">
                <button class="close-modal">&times;</button>
            </div>
            <div class="row row2">
                <div class="col-2">
                    
                </div>
                <div class="col-2">
                    <p>Home / Books</p>
                    <h1>Mindful Learning</h1>
                    <h4>Price: $150</h4>
                    <h4>Quantity: </h4>
                    <select>
                        <option>1</option>
                        <option>2</option>
                        <option>3</option>
```

```
<option>4</option>
<option>5</option>
</select>
<br>
<a href="" class="btn">Add To Cart</a>
</div>
</div>
</div>
</div>
<div id="overlay"></div>
<!-------End Modal----->
</body>
<!-------JavaScript----->
<script src="main.js"></script>
</html>
```

Add the code for the filters in **main.js** file as shown in Code Snippet 21 from **line 67** onwards.

Code Snippet 21:

```
//Search functionality
function filter() {
    var filterValue, input, ProductList,ProductName,h4,i;
    input = document.getElementById("search");
    filterValue = input.value.toUpperCase();
    ProductList = document.getElementById("product-list");
    ProductName = ProductList.getElementsByClassName("col-4");
    for (i = 0 ; i < ProductName.length ; i++){
        h4 = ProductName[i].getElementsByTagName("h4")[0];
        //In search if typed string matches with the element name.
        if(h4.innerHTML.toUpperCase().indexOf(filterValue) > -1){
            ProductName[i].style.display = "";
        }
        else{
            ProductName[i].style.display = "none";
        }
    }
}
```

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```
var ProductList, ProductName, i, switching, b, c, shouldSwitch;
ProductName = document.getElementById("product-list");
ProductName = ProductList.getElementsByClassName("col-4");
switching = true;//boolean true
while (switching) {
    switching = false;
    //loop is running through each product
    for (i = 0 ; i < (ProductName.length - 1) ; i++) {
        shouldSwitch = false;
        b = ProductName[i].getElementsByTagName("span") [0].innerHTML;
        c = ProductName[i+1].getElementsByTagName("span") [0].
            innerHTML;
        //Condition to check price for each product item
        if (Number(b) > Number(c)) {
            shouldSwitch = true;
            break;
        }
    }
    // Each product element will switch with next product element based on
    //product price sorting
    if (shouldSwitch) {
        ProductName[i].parentNode.insertBefore(ProductName[i + 1],
        ProductName[i]);
        switching = true;
    }
}
}
```

Update the CSS for the Products page specifying style for the Search box as shown in Code Snippet 22 from **line 248** onwards.

Code Snippet 22:

```
//Sort product by price
function sortList() {
/* Search in product page css */
.row-2{
    justify-content: space-between;
    margin: 100px auto 50px;
}
```

```
select{
    border: 1px solid #ff523b;
    padding: 5px;
}
select ::focus{
    outline: none;
}
.page-btn{
    margin: 0 auto 80px;
}
.page-btn span{
    display: inline-block;
    border: 1px solid #ff523b;
    margin-left: 10px;
    width: 40px;
    height: 40px;
    text-align: center;
    line-height: 40px;
    cursor: pointer;
}
.page-btn span:hover{
    background-color: #ff523b;
    color: #fff;
}
.single-product {
    margin-top: 80px;
    margin-bottom: 80px;
}
.single-product .col-2 img{
    padding: 0;
}
.single-product .col-2{
    padding: 20px;
}
    .single-product h4{
        margin: 20px 0px;
        font-size: 22px;
        font-weight: bold;
    }
```

```
        }
.single-product select{
    display: block;
    padding: 10px;
    margin-top: 10px;
}
.submitbtn{
    margin: auto;
    text-align: center;
}
#error_message{
    margin-bottom: 20px;
    background: #fe8b8e;
    padding: 0px;
    text-align: center;
    font-size: 14px;
    transition: all 0.5s ease;
}
#search {
    border: 1px solid #ff523b;
    padding: 10px;
    width: 280px;
}
```

Save the file. Place the images for the Website under **images** folder. With this, the Website is ready. Launch a browser window and view the index.html file in the browser. Figures 16.3 to 16.7 display various pages on the site.

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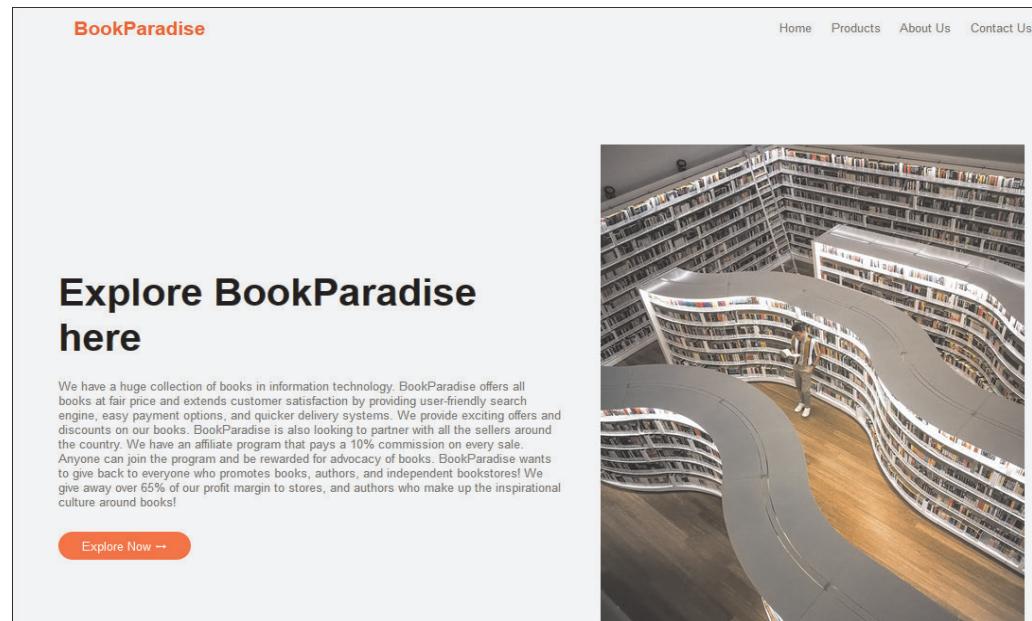


Figure 16.3: Index Page

Featured Products

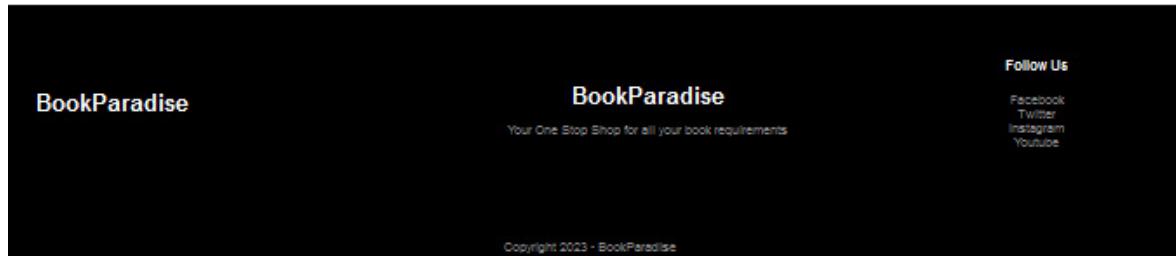
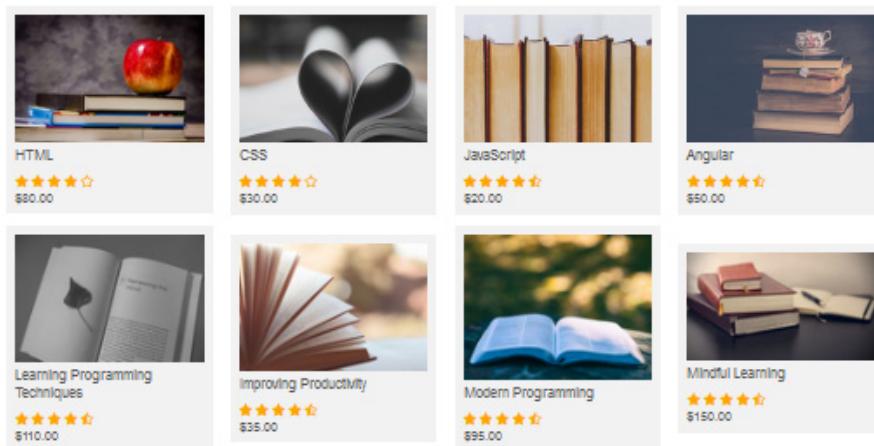


Figure 16.4: Index Page (After Scrolling Down)

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BookParadise

Home Products About Us Contact Us

All Products

Search here

Sort By Price

HTML
★★★★☆
\$80

CSS
★★★★★
\$30

JavaScript
★★★★★
\$20

Angular
★★★★★
\$50

Learning Techniques
★★★★★
\$110

Improving Productivity
★★★★★
\$35

Modern Learning
★★★★★
\$95

Mindful Learning
★★★★★
\$150

1 2 3 4 →

Follow Us

Facebook

Figure 16.5: Product Page

Explore details of each product by clicking the product image. This will result in a modal popup displaying the product details. Examine the Search and Sort by price functionalities.

Note that though Pagination buttons are included at the bottom, currently they are not associated with any action or functionality.

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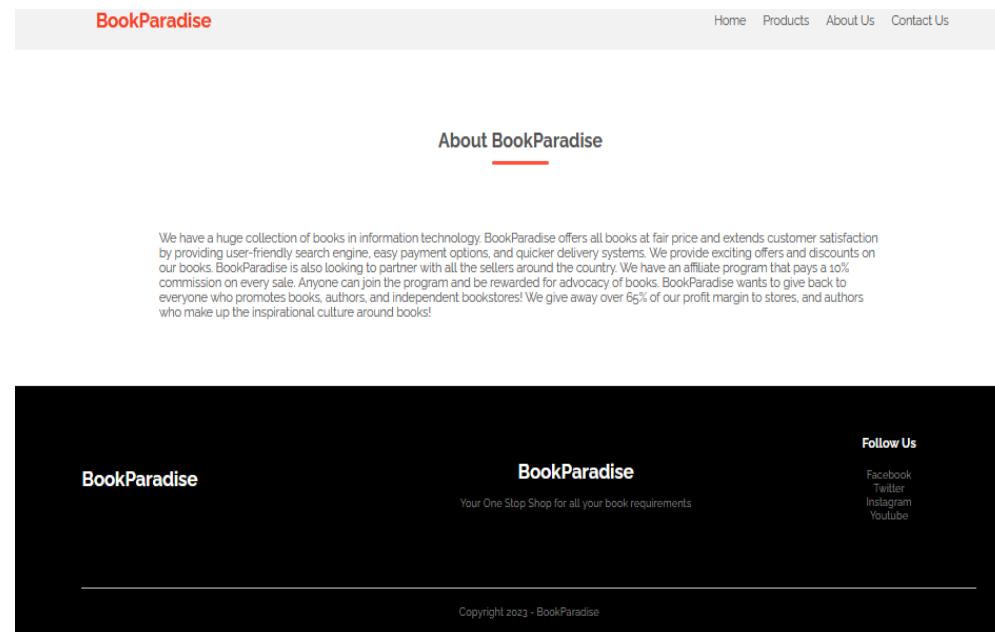


Figure 16.6: About Us Page

A screenshot of the BookParadise website's Contact Us page. The header features the logo 'BookParadise' in orange. The navigation bar includes links for Home, Products, About Us, and Contact Us. The main content area has a heading 'Contact us' with a red underline. Below it is a form with five input fields labeled 'Name', 'Subject', 'Phone', 'Email', and 'Message'. A red 'Submit Query' button is located at the bottom right of the form. The entire contact form is enclosed in a light gray border.

Figure 16.7: Contact Us Page

Thus, you have successfully created a Website based on a real-world case study.