

Responsive Web Design

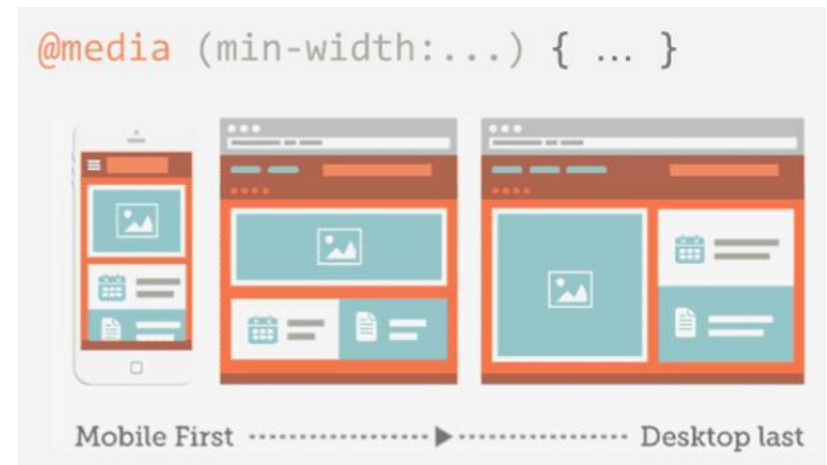
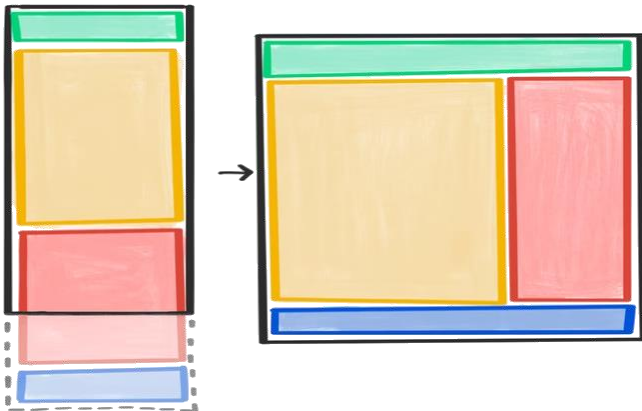


Outline

1. Flexbox
2. Grid
3. Media Queries
4. Common Layout Patterns

Responsive Web Design (RWD)

- RWD is an approach to **serve different layouts for different screen sizes**
 - **Optimize the viewing experience on range of devices:** mobile, desktop, tablet, TV...
 - Can be accomplished using CSS **grid/flexbox** & **media queries**
 - **Mobile-first layouts** work well on all screen widths: start with single column layout for smaller screens



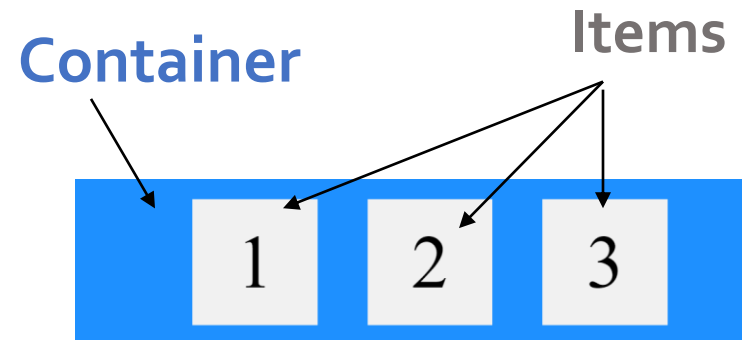


Flexbox

- The Flexbox provide an efficient way to define **one-dimensional layout** that allows easy control of **space distribution** and **alignment** of items in a container
 - Enable **responsive design** to accommodate different screen sizes

```
.flex-container {  
  display: flex;  
  column-gap: 1rem;  
  justify-content: center;  
}
```

```
<div class="flex-container">  
  <div>1</div>  
  <div>2</div>  
  <div>3</div>  
</div>
```



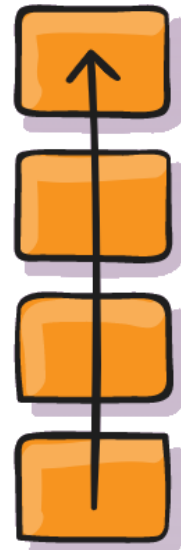
https://www.w3schools.com/css/css3_flexbox.asp

Flex Container Properties

- flex-direction
- flex-wrap
- justify-content
- align-items
- align-content

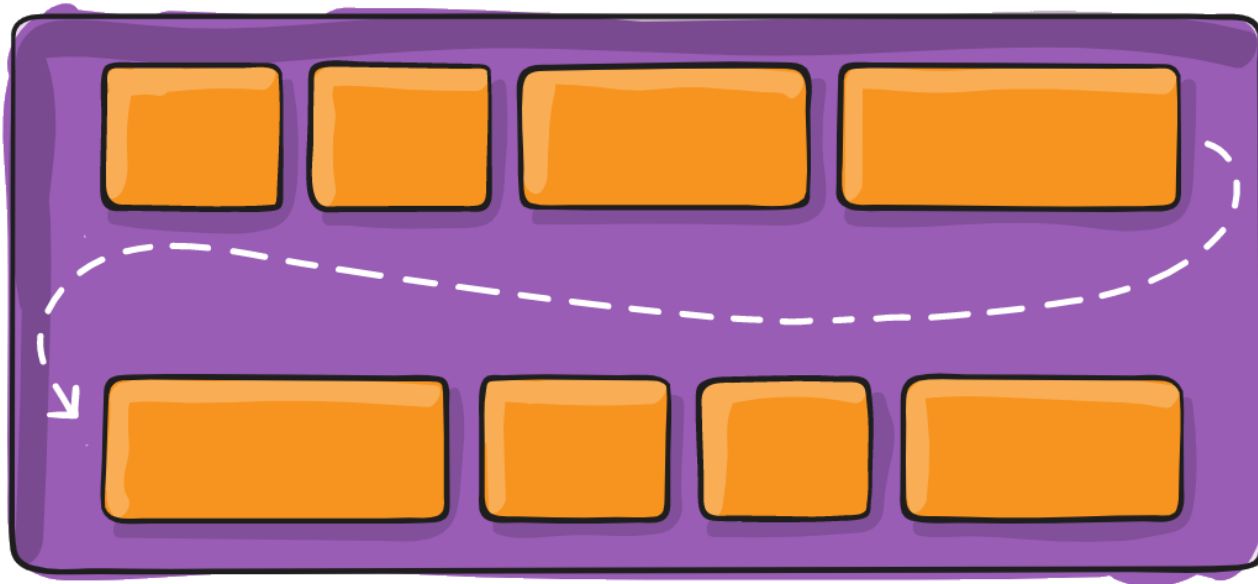
flex-direction

- Layout Flex items either in **horizontal rows** or **vertical columns**:
 - **row** (**default**): left to right
 - **row-reverse**: right to left
 - **column**: top to bottom
 - **column-reverse**: bottom to top

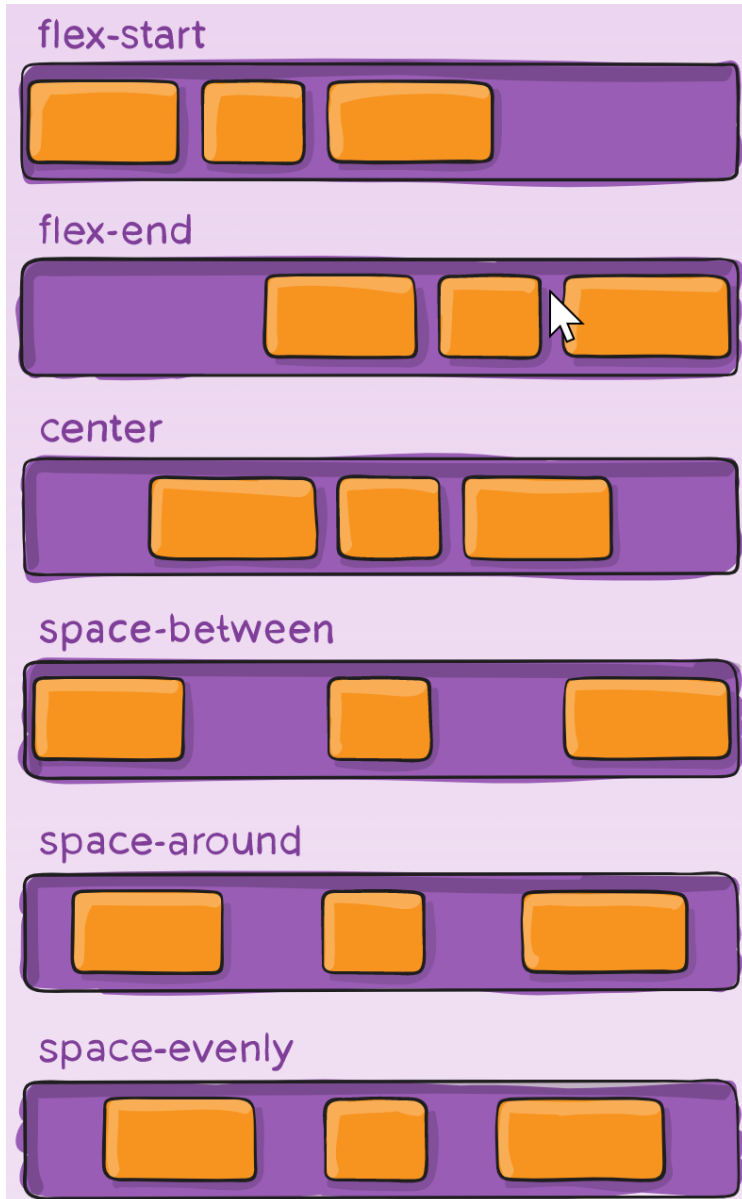


flex-wrap

- **nowrap** (default): all flex items will be on one line
- **wrap**: flex items will wrap onto multiple lines, from top to bottom
- **wrap-reverse**: flex items will wrap onto multiple lines from bottom to top



justify-content

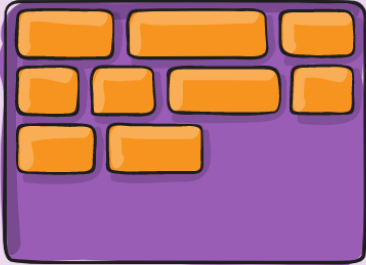


- Distribute extra leftover **free space** along the **main axis**
- **flex-start** is the **default**: items are packed toward the start

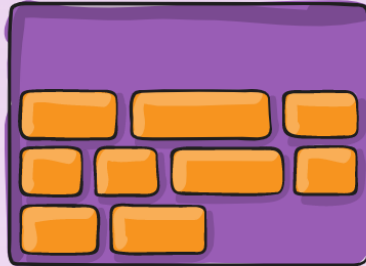
align-content

align-content

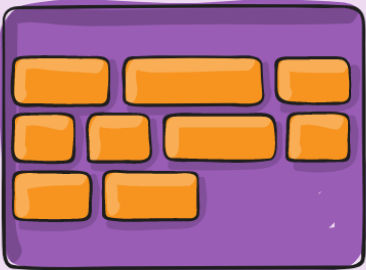
flex-start



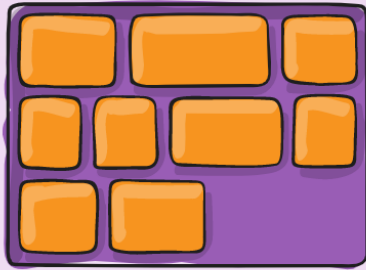
flex-end



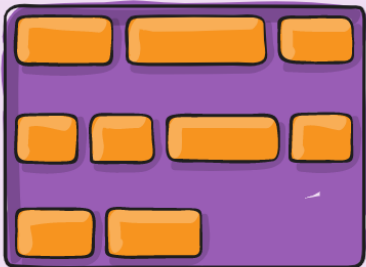
center



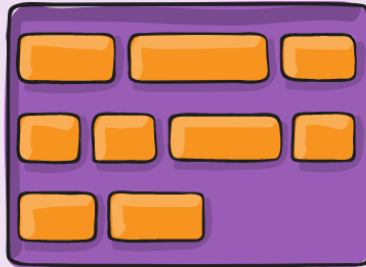
stretch



space-between



space-around

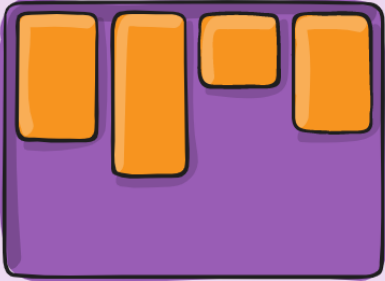


- Distribute extra leftover free space along the **cross axis**
- stretch is the **default**: lines stretch to take up the remaining space

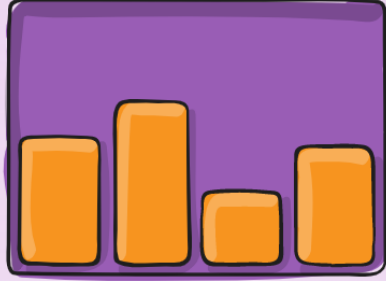
align-items

align-items

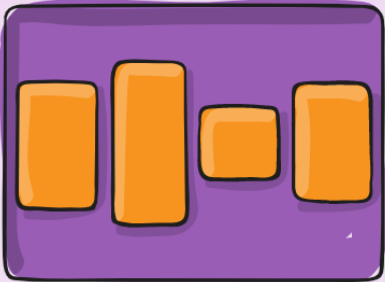
flex-start



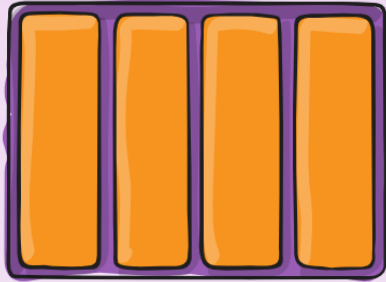
flex-end



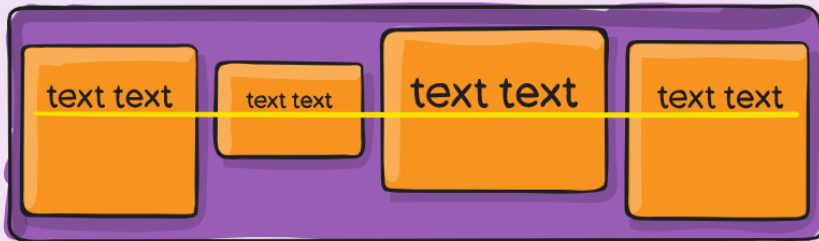
center



stretch



baseline



- Defines how flex items are laid out along the cross axis
- Stretch is the **default**: flex items stretch to fill the container

Properties for flex items

- order
- flex-grow
- flex-shrink
- flex-basis
- align-self

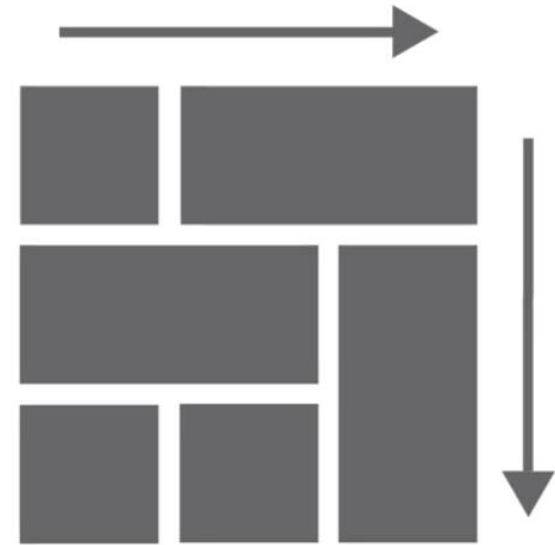
https://www.w3schools.com/css/css3_flexbox_items.asp

<https://css-tricks.com/snippets/css/a-guide-to-flexbox/>



CSS Grid

- CSS Grid is a **two-dimensional layout** system to design the page layout
- Can specify columns/rows template
- Grid elements can be auto-placed or explicitly placed using grid lines or grid areas



CSS Grid
TWO DIMENSIONS

Watch and practice @

<https://mozilladevelopers.github.io/playground/css-grid>

Grid container

- Grid **container** is defined by setting the *display* property of the container element to *grid*

- CSS:

```
.page {  
    display: grid;  
}
```

```
.page  
<div class="page">  
  <header class="head">  
  </header>  
  
  <main class="main-content">  
  </main>  
  
  <aside class="sidebar">  
  </aside>  
  
  <footer class="footer">  
  </footer>  
</div>
```

This creates a grid container

Grid item

- Grid item = *Element that is a direct descendant of the grid container*

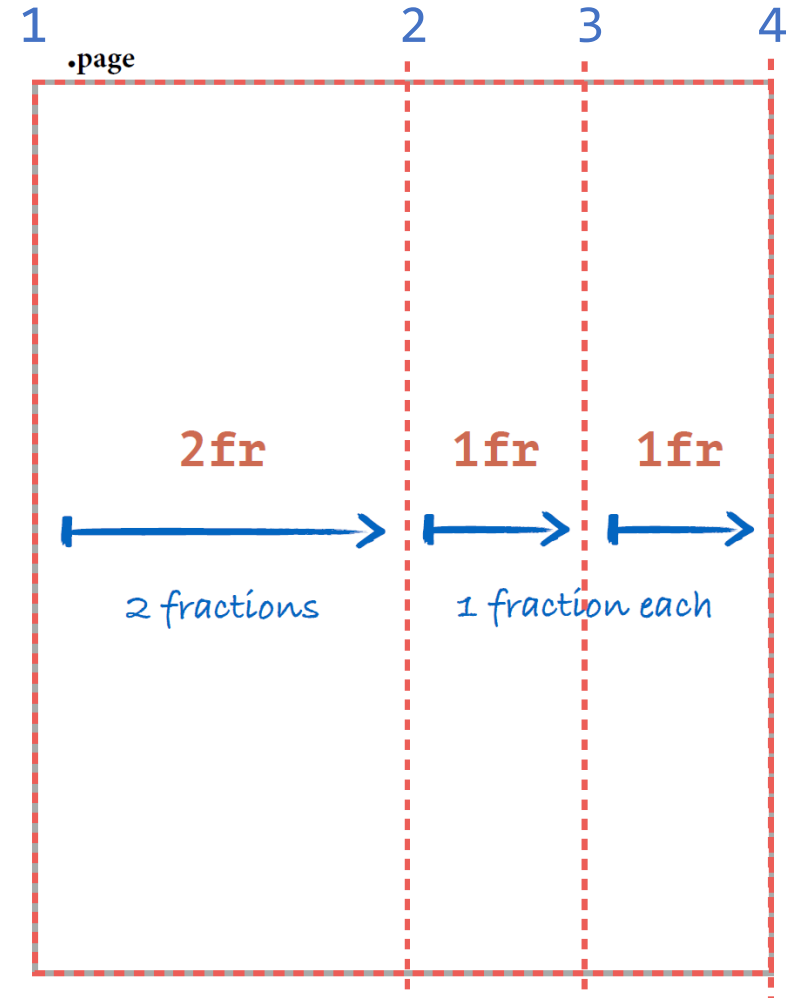
```
<div class="page">  
  <header class="head">  
  </header>  
  <main class="main-content">  
  </main>  
  <aside class="sidebar">  
  </aside>  
  <footer class="footer">  
  </footer>  
</div>
```



Grid columns

`grid-template-columns:`
2fr 1fr 1fr;

Defines grid columns
having the desired size
(em, px, %, **fr**)

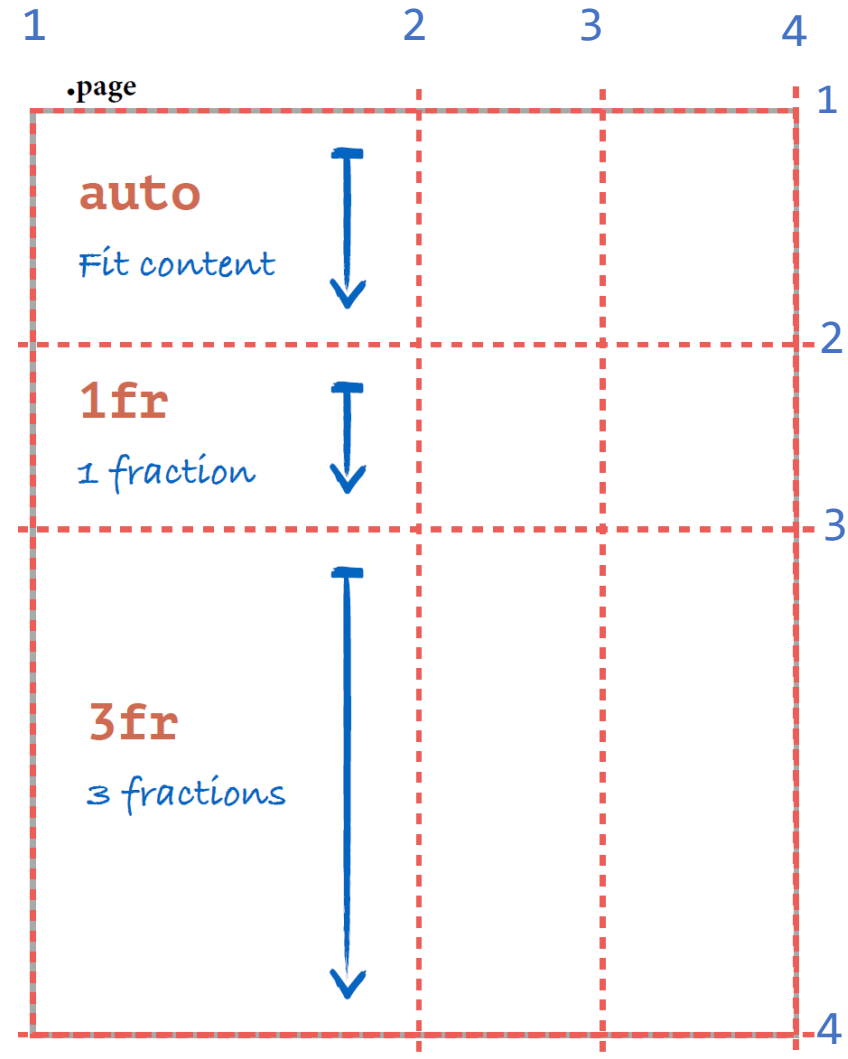


Grid rows

`grid-template-rows:`

`auto 1fr 3fr;`

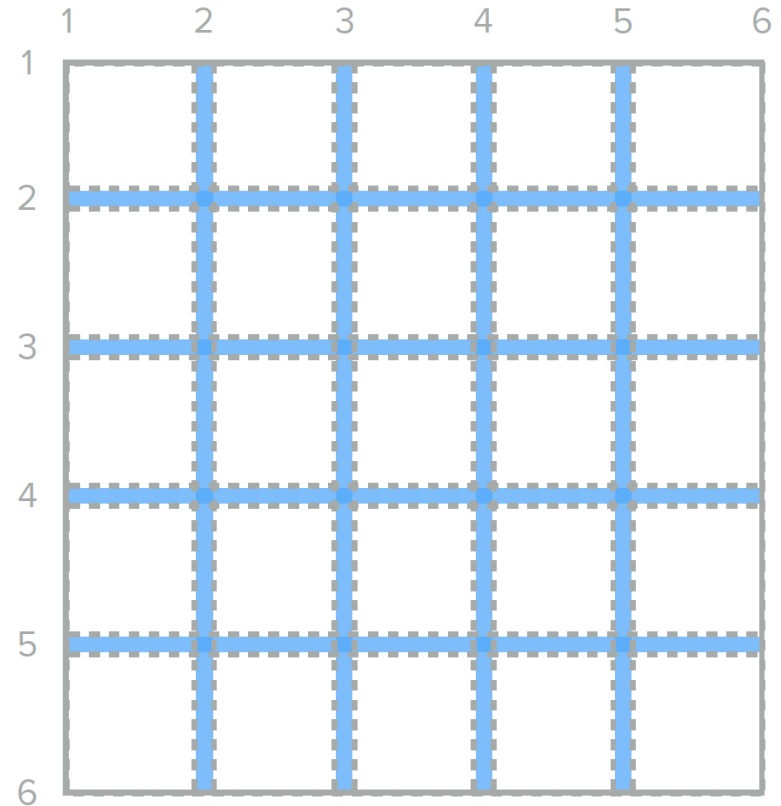
Defines grid rows having the desired size (em, px, %, **fr**)



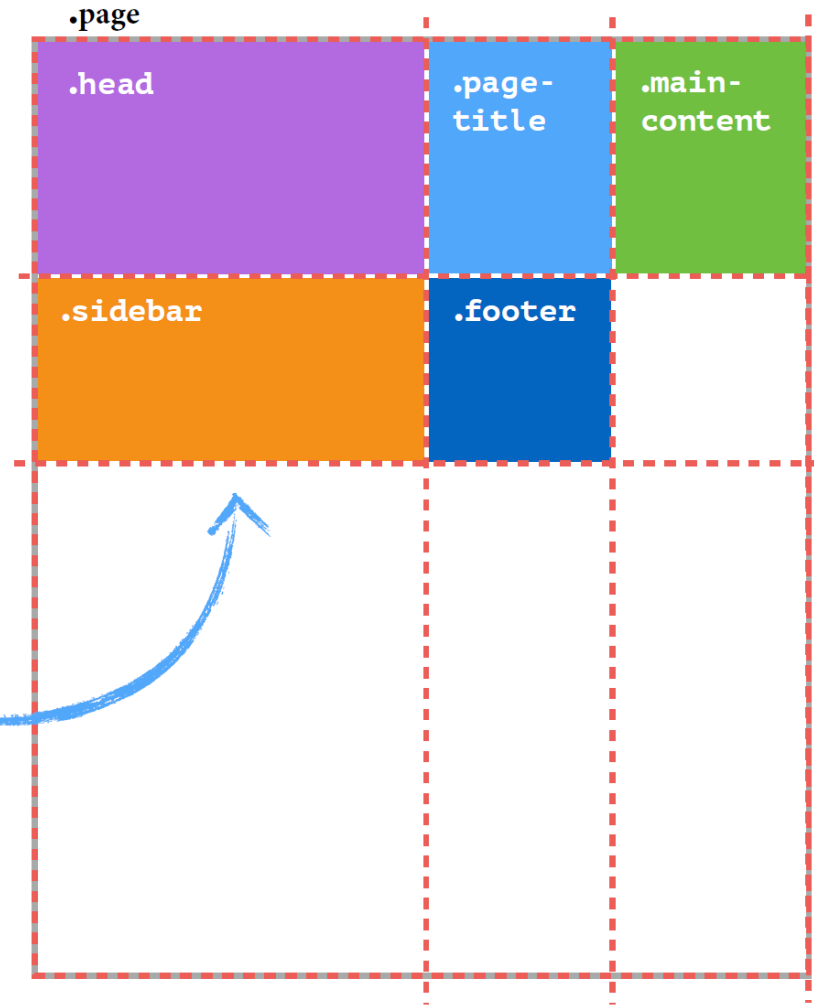
Grid gap

- Empty space between grid tracks (shown in **blue**)
- Commonly called *gutters*

```
.page {  
    display: grid;  
    grid-gap: 10px;  
}
```



Grid items automatically populate grid from top left to bottom right based on HTML source order.



Placing Items using Grid Lines

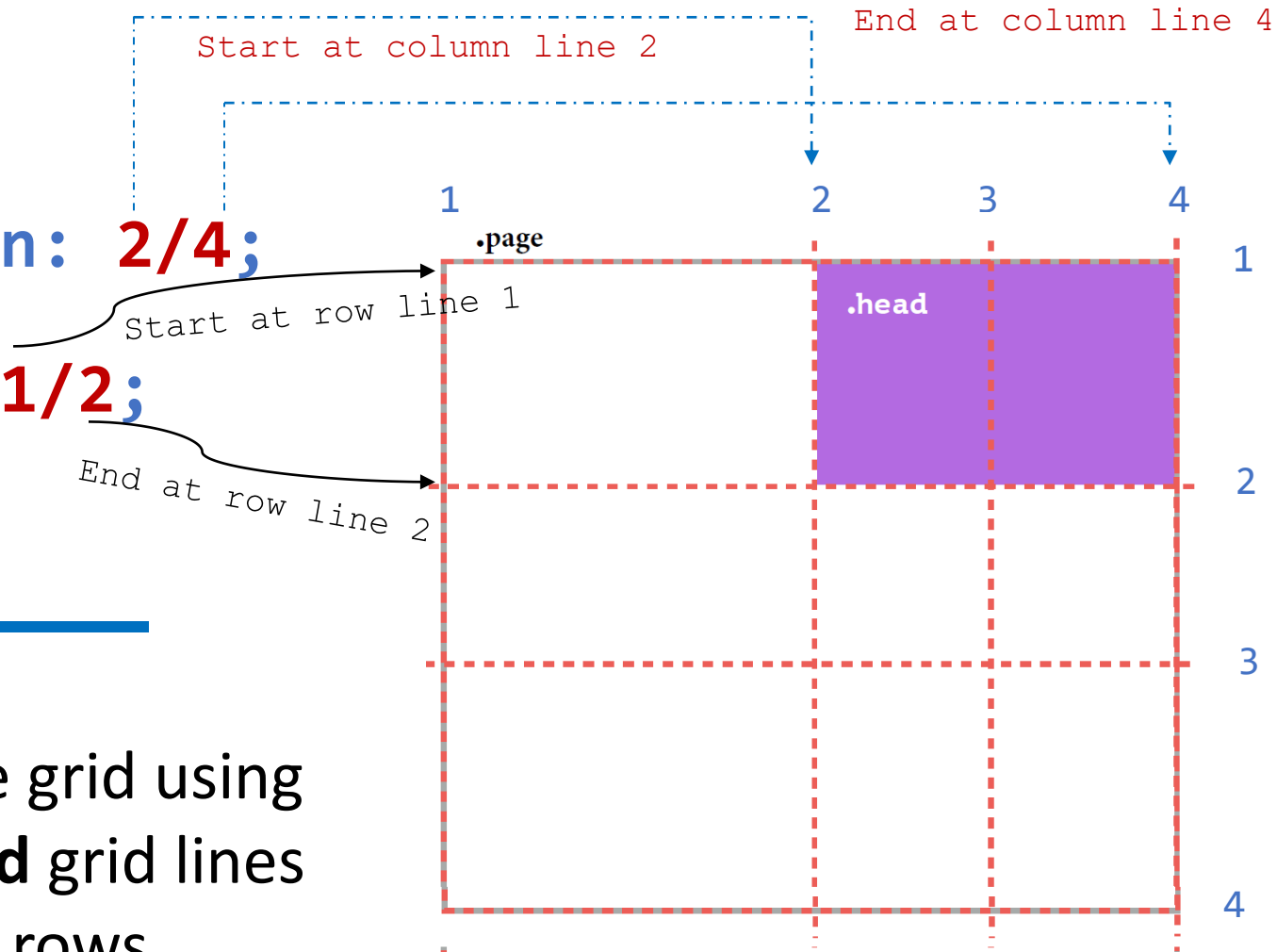
```
.head {
```

```
  grid-column: 2/4;
```

```
  grid-row: 1/2;
```

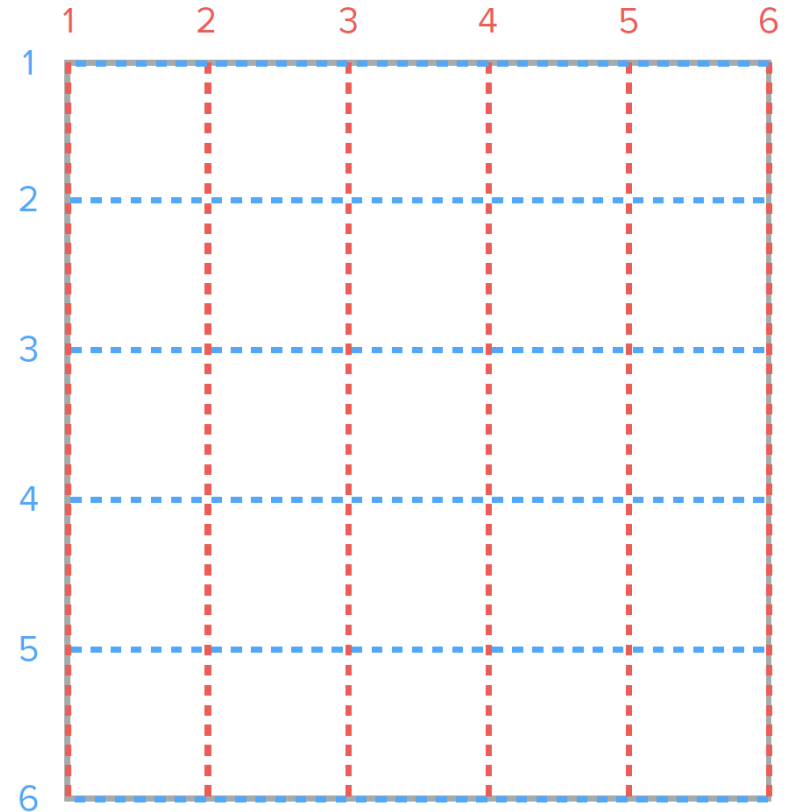
```
}
```

Place item in the grid using
the **start** and **end** grid lines
for columns and rows



Grid line

- Horizontal (**row**) or vertical (**column**) line separating the grid into sections
- Grid lines are referenced by numbers, starting and ending with the outer borders of the grid



Example

```
.container {  
  display: grid;  
  grid-template-columns: auto 1fr auto;  
  grid-template-rows: auto 1fr auto;  
}
```

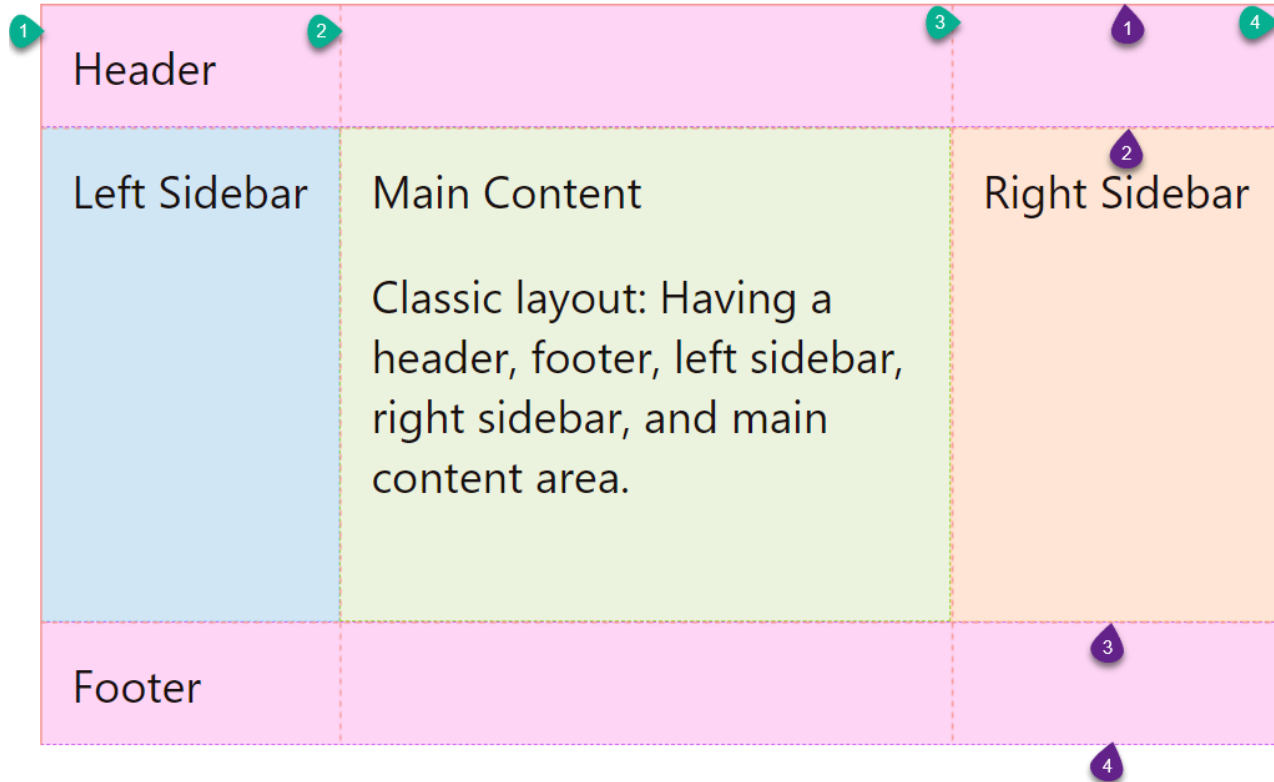
```
header {  
  grid-column: 1 / 4;  
}
```

```
.left-side {  
  grid-column: 1 / 2;  
}
```

```
main {  
  grid-column: 2 / 3;  
}
```

```
.right-side {  
  grid-column: 3 / 4;  
}
```

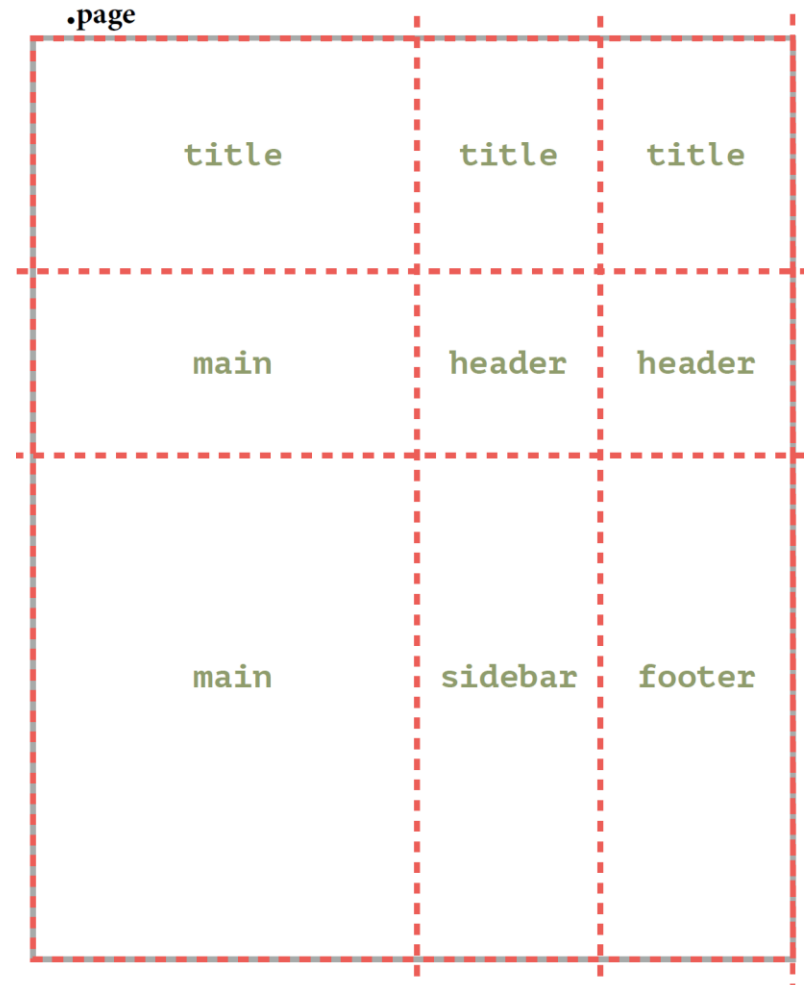
```
footer {  
  grid-column: 1 / 4;  
}
```



Define grid areas

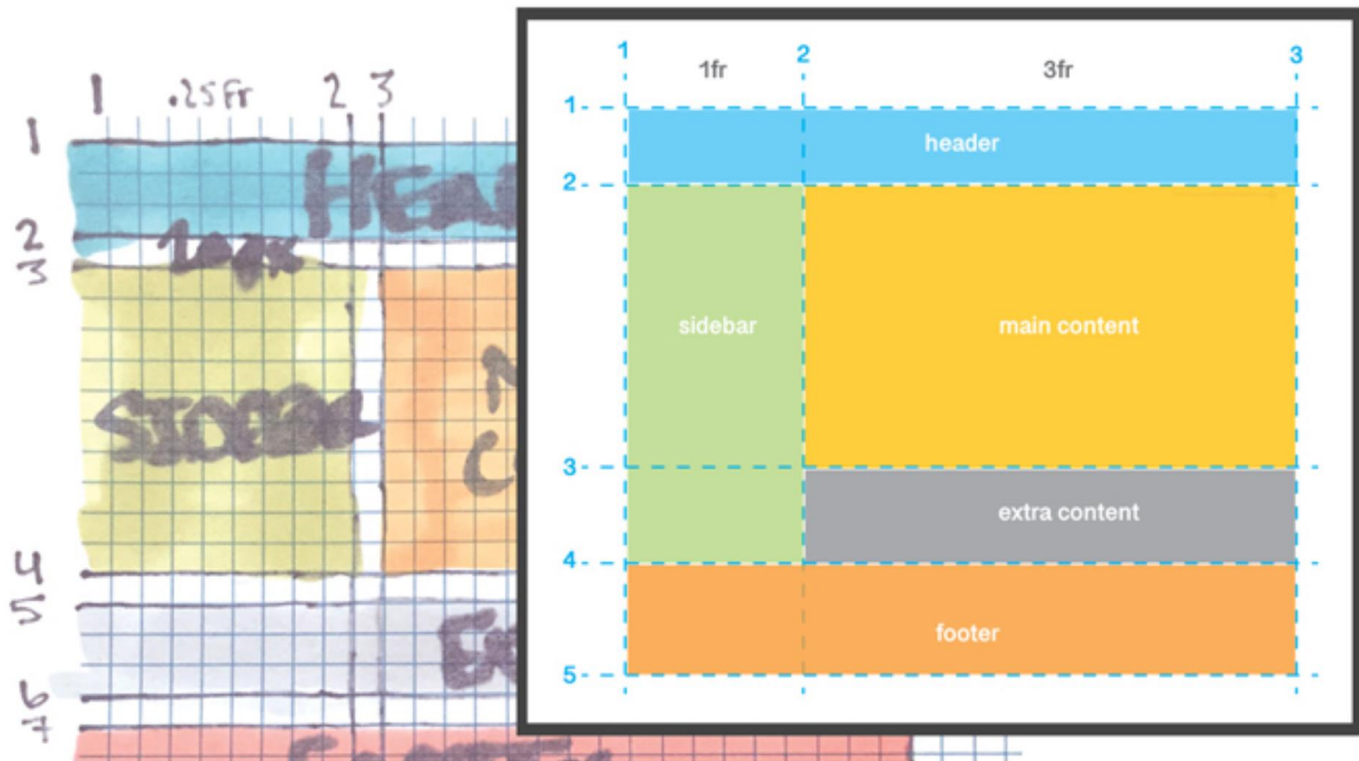
```
.page {  
  display: grid;  
  grid-template-columns: 2fr 1fr 1fr;  
  grid-template-rows: auto 1fr 3fr;  
  grid-template-areas:  
    "title title title"  
    "main header header"  
    "main sidebar footer";  
}
```

grid-template-areas
is used to define named grid areas



Grid areas

- Defining grid areas and using them to place elements is **best way** to design the page layout as it allows direct translation of the paper-based design to a CSS grid



Placing items in the grid areas

```
.page {  
  display: grid;  
  grid-template-columns: 2fr 1fr 1fr;  
  grid-template-rows: auto 1fr 3fr;  
  grid-template-areas:  
    "title title title"  
    "main header header"  
    "main sidebar footer";  
}
```

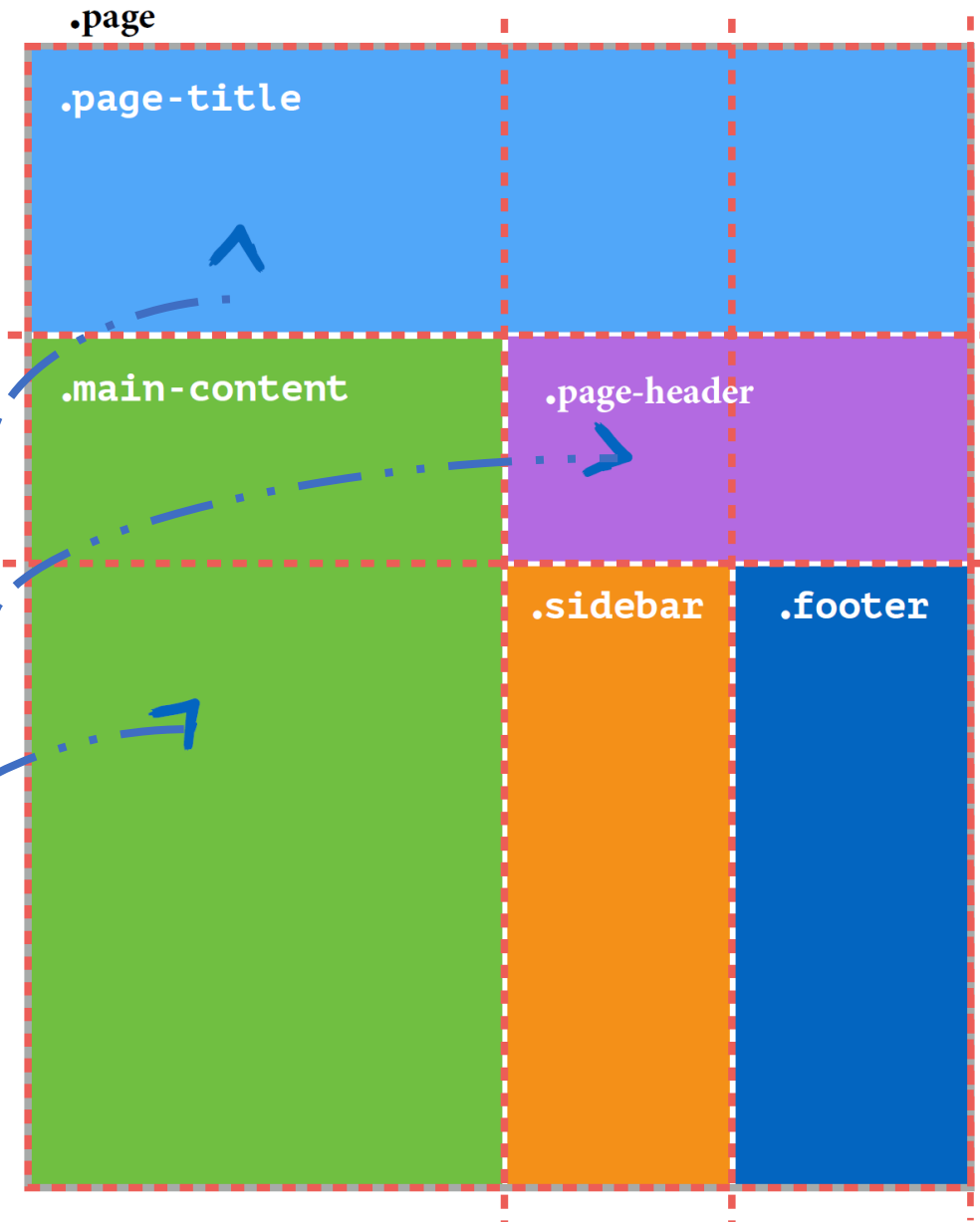
/ Placing items in the grid areas: */*

```
.page-title {  
  grid-area: title;  
}
```

```
.page-header {  
  grid-area: header;  
}
```

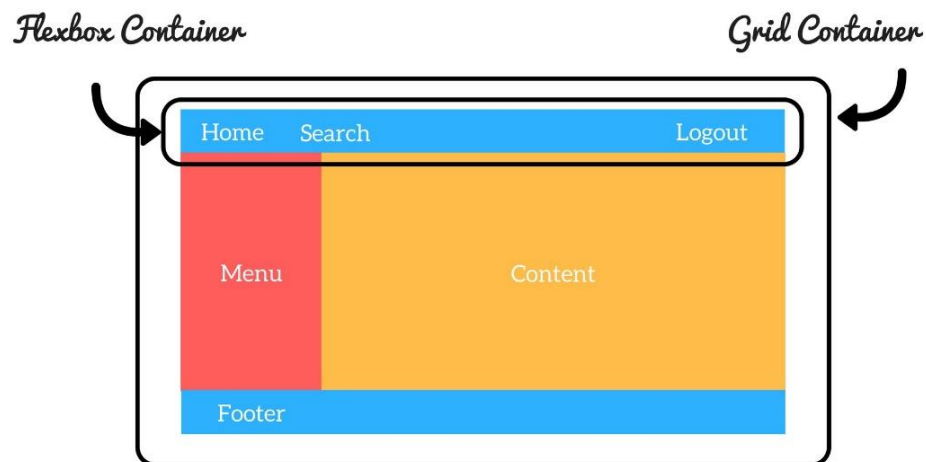
```
.main-content {  
  grid-area: main;  
}
```

/ etc etc */*



Grid vs Flexbox

- Grid Layout is a **two-dimensional** system with columns and rows, unlike flexbox which is a **one-dimensional system** (either in a column or a row).
- In practice you combine these layout models. Often you can use a Flexbox container inside a Grid container
 - Grid is often used for the overall page layout (i.e., **Macro layouts** describing the larger, page-wide organization) while the **flexbox is used for small-scale** one-dimensional layouts (e.g., menu or card layout)



Media Queries

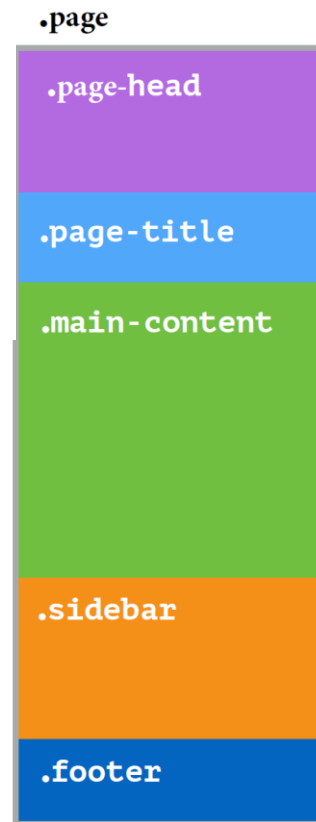
Responsive page layout using Media Queries

Use media queries to define layouts for different screen sizes

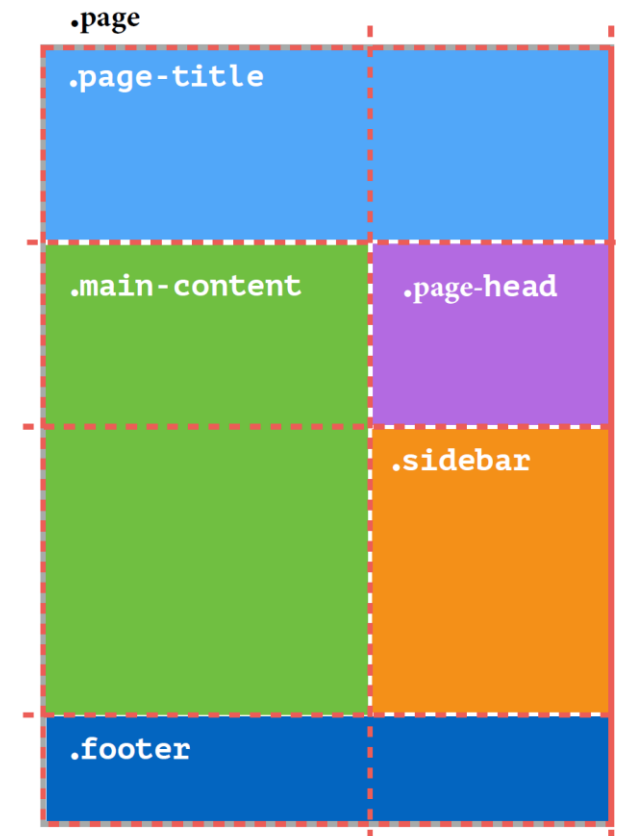
```
@media screen and (min-width: 700px) {  
  .page {  
    display: grid;  
    grid-template-columns: 2fr 1fr 1fr;  
    grid-template-rows: auto 1fr 3fr;  
    grid-template-areas: "title title"  
                        "main header"  
                        "main sidebar"  
                        "footer footer";  
  }  
}
```

- This examples applies two-column layout once the screen width is above a specified **breakpoint**
- Media queries allows defining layouts for different screen sizes

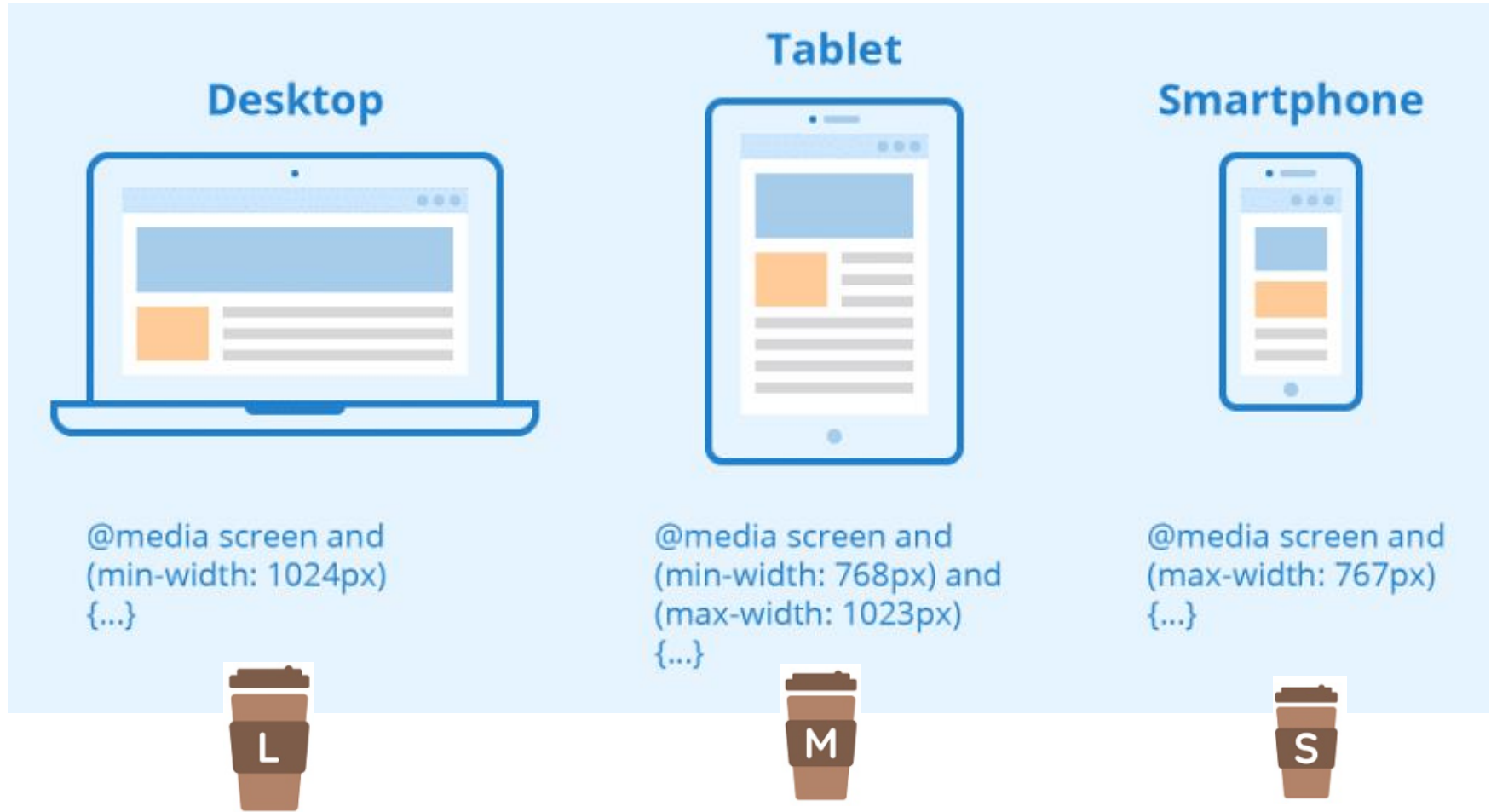
No grid



Two-column grid
(when page width $\geq 700px$)



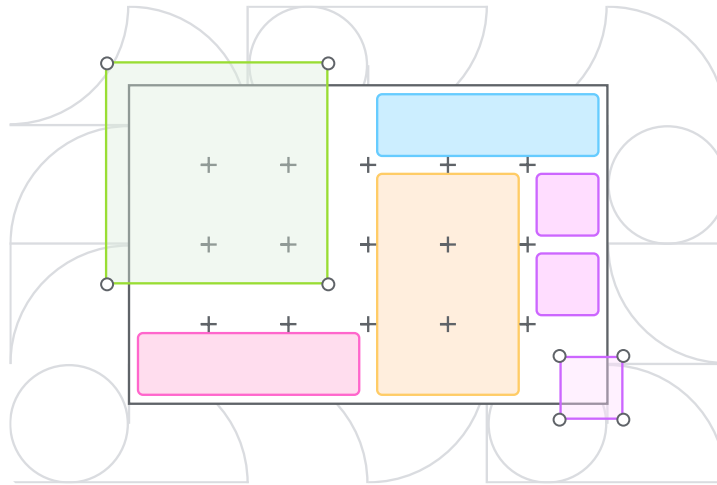
Common breakpoints



Source: <https://kinsta.com/blog/responsive-web-design/>

Common Layout Patterns

<https://web.dev/patterns/layout/>



Menu using a flexbox

- A website menu could be created using a `ul` element with `display: flex`

[Home](#) [About](#) [Contact us](#)

```
<nav>
  <ul>
    <li><a href="#">Home</a></li>
    <li><a href="#">About</a></li>
    <li><a href="#">Contact us</a></li>
  </ul>
</nav>
```

```
nav ul {
  width: 90%;
  display: flex;
  column-gap: 1rem;
  row-gap: 0.4rem;
  flex-wrap: wrap;
}
nav ul li {
  list-style: none;
}
```


Line-up card

justify-content: space-between

- Flexbox column card with **justify-content: space-between**
 - places the first and last child elements (e.g., title and image) at the edges of the flex container
 - the remaining space evenly distributed between the elements
 - e.g., the descriptive text in between gets placed with equal spacing to each endpoint

Aspect ratio Image Card

aspect-ratio: <width> / <height>

- Maintains the aspect ratio of an image in a card, while resizing the card.
- With the **aspect-ratio** property, as you resize the card, the image maintains the desired aspect ratio
 - e.g., maintains 16 x 9 aspect ratio as you resize the card

```
.card img {  
    aspect-ratio: 16 / 9;  
}
```

Clamping card

`clamp(<min>, <actual>, <max>)`

- Sets an absolute min and max size, and an actual size for the card

```
.card {  
    width: clamp(23ch, 40%, 46ch);  
}
```

- Min size is 23 characters, max size is 46ch, actual size is 40% of the parent width
 - Width of the card increases to the max size and decreases to its min size as the parent stretches and shrinks
 - Enables more legible layouts, as the text won't be too wide (above 46ch) or too narrow (below 23ch)

Deconstructed pancake

flex: <flex-grow> <flex-shrink> <base-width>

- Create a layout that stretches to fit the available space and wraps to the next line to maintain a minimum size (specified in base-width)
- On smaller screens, the boxes would stack nicely
 - set the value of <flex-grow> to 1 => flex items grow as you increase the screen size
 - set the value of <flex-shrink> to 1 => flex items shrink as you decrease the screen size
 - when needed wraps to the next line to maintain the minimum base-width

Pancake stack

grid-template-rows: auto 1fr auto

- Commonly referred to as a sticky footer
- **grid-template-rows: auto 1fr auto**

- auto = auto-sized based on content

Header and footer are auto-sized based on their content

- main content area occupies the remaining space (1fr)

Sidebar says

`grid-template-columns: minmax(<min>, <max>) 1fr`

- A layout where the sidebar is given a minimum and maximum safe area size, and the rest of the content fills the available space.

`grid-template-columns: minmax(100px, 20%) 1fr;`

- **minmax()** function is used to set the minimum sidebar size to 100px, but letting it stretch out to 20% on larger screens
 - the main content takes up the rest of the space (1fr)

Classic layout

grid-template: auto 1fr auto / auto 1fr auto

- Classic layout with a header, footer, left sidebar, right sidebar, and main content area.
- **grid-template: auto 1fr auto / auto 1fr auto**
rows and columns templates separated by slash
 - auto = auto-sized based on content
header, footer and sidebars are auto-sized based on their content
 - main content area occupies the remaining space (1fr)
 - grid lines are used for placing the grid items

RAM (Repeat, Auto, Minmax)

`grid-template-columns: repeat(auto-fit, minmax(<base>, 1fr))`

- A responsive layout with auto-created grid columns and automatically-placed children

`grid-template-columns: repeat(auto-fit, minmax(280px, 1fr));`

Browser!

- Use RAM (Repeat-Auto-fit-Minmax) to create **dynamic grid areas**
- I want you to **auto-create the grid columns** you decide how many you can fit using the auto-placement algorithm
- I want the columns to be minimum 280px and a maximum of **sharing the available space equality among the columns**





[See posted example](#)

Super centered

`place-items: center`

- Use grid's `place-items: center` to center an element within its parent
 - `place-items: center` is a shorthand that sets both `align-items` and `justify-items` to center

Summary

- Use Grid any time you work with *two-dimensional* layouts to divide the page into several sections having different size and position
- Use Flexbox for *one-dimensional* layout that offers space allocation between items + the ability to alter its items' width/height (and order) to best fill the available space
- Use Grid layout and Media Queries (when needed) for responsive design
- .. mastering CSS needs hands-on practice   ...

Resources

- Responsive Design Patterns
 - <https://web.dev/patterns/layout/>
 - <https://web.dev/learn/design/>
- Responsive Web Design Code Camp
 - <https://www.freecodecamp.org/learn/responsive-web-design/>
- Flexbox
 - <https://css-tricks.com/snippets/css/a-guide-to-flexbox/>
 - <https://marina-ferreira.github.io/tutorials/css/flexbox/>
- CSS Grid
 - <https://1linelayouts.glitch.me/>
 - https://developer.mozilla.org/en-US/docs/Web/CSS/CSS_Grid_Layout
 - <https://gridbyexample.com/learn/>
 - <https://css-tricks.com/snippets/css/complete-guide-grid/>
 - <https://mozilladevelopers.github.io/playground/css-grid/>