

# Responsive Web Design

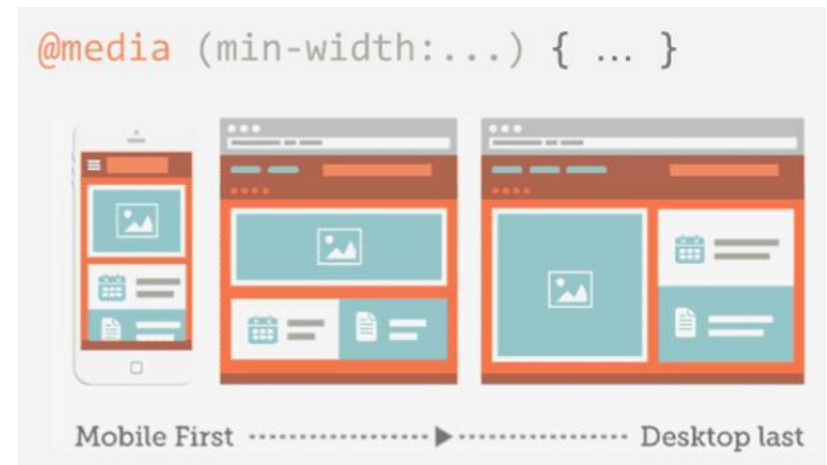
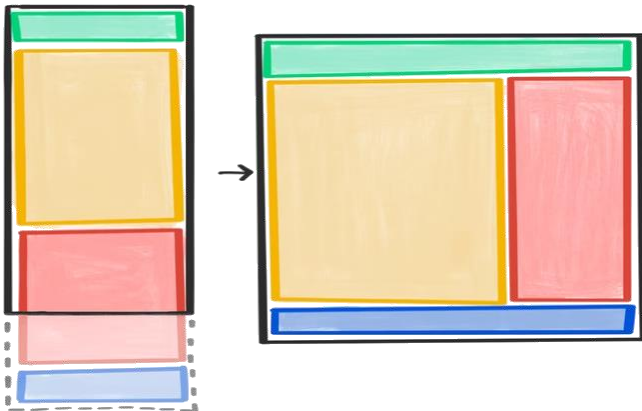


# Outline

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



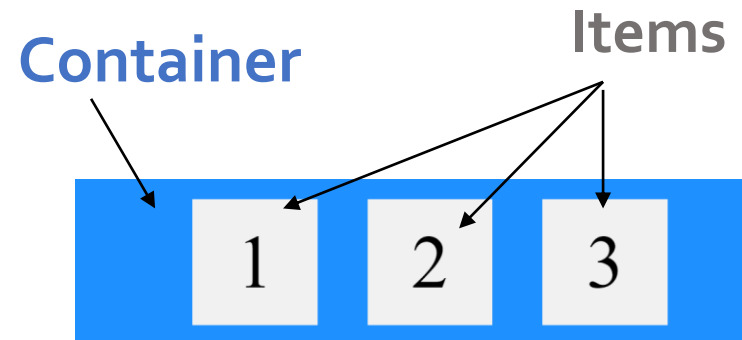


# Flexbox

- The Flexbox provide an efficient way to **lay out, align** and **distribute space** among items in a container
  - Defines **one-dimensional layout**
  - A flex container expands items to fill available free space or shrinks them to prevent overflow

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

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

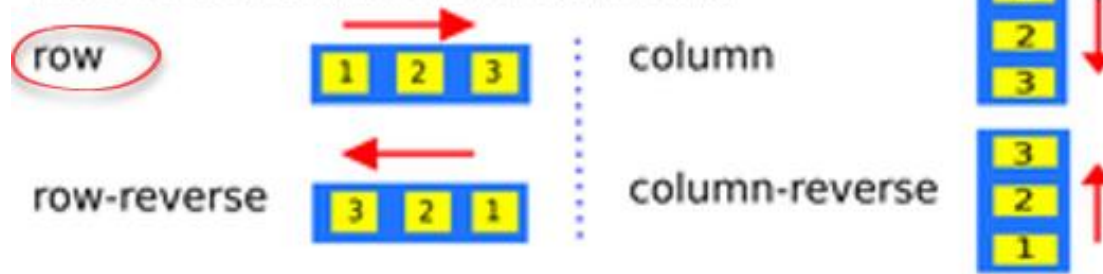


[https://www.w3schools.com/css/css3\\_flexbox.asp](https://www.w3schools.com/css/css3_flexbox.asp)

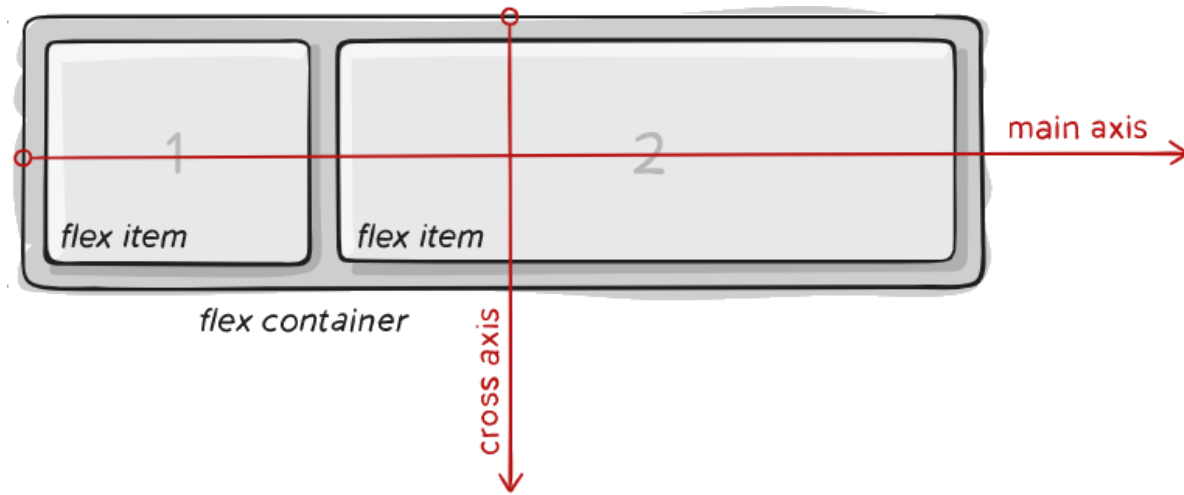
# Flex Container Properties

- **flex-direction**: either row (default) or column
- **flex-wrap**: By default, nowrap: all flex items will be on 1 line. Assign wrap to allow flex items to wrap onto multiple lines
- **justify-content**: aligns and arranges flex-items along the main axis
- **align-items**: aligns items within a flex line, along the cross-axis
- **align-content**: aligns and manages spacing between **multiple lines** when items wrap

**flex-direction:** sets the main-axis.



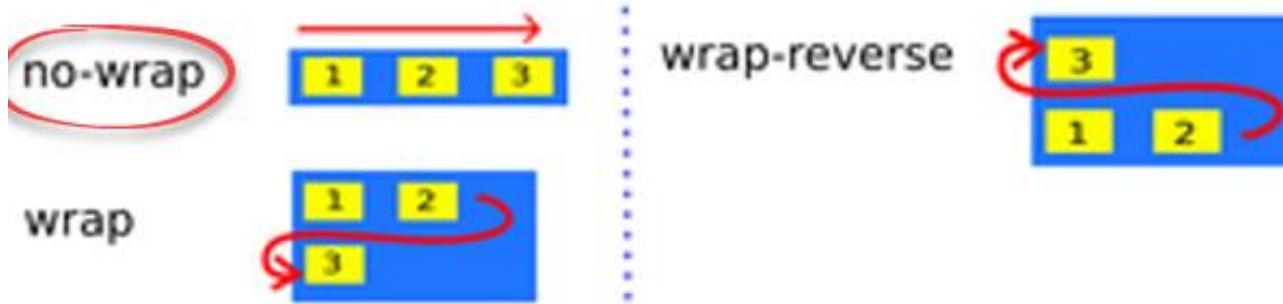
**row** (default):  
horizontal  
alignment



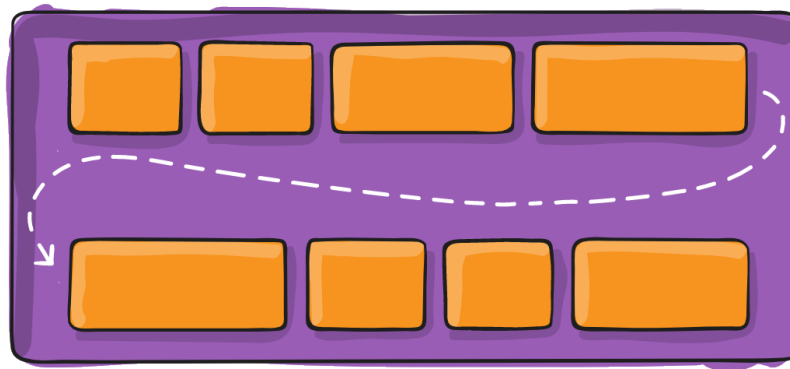
**column:** vertical alignment



**flex-wrap:** allows the items to wrap as needed.

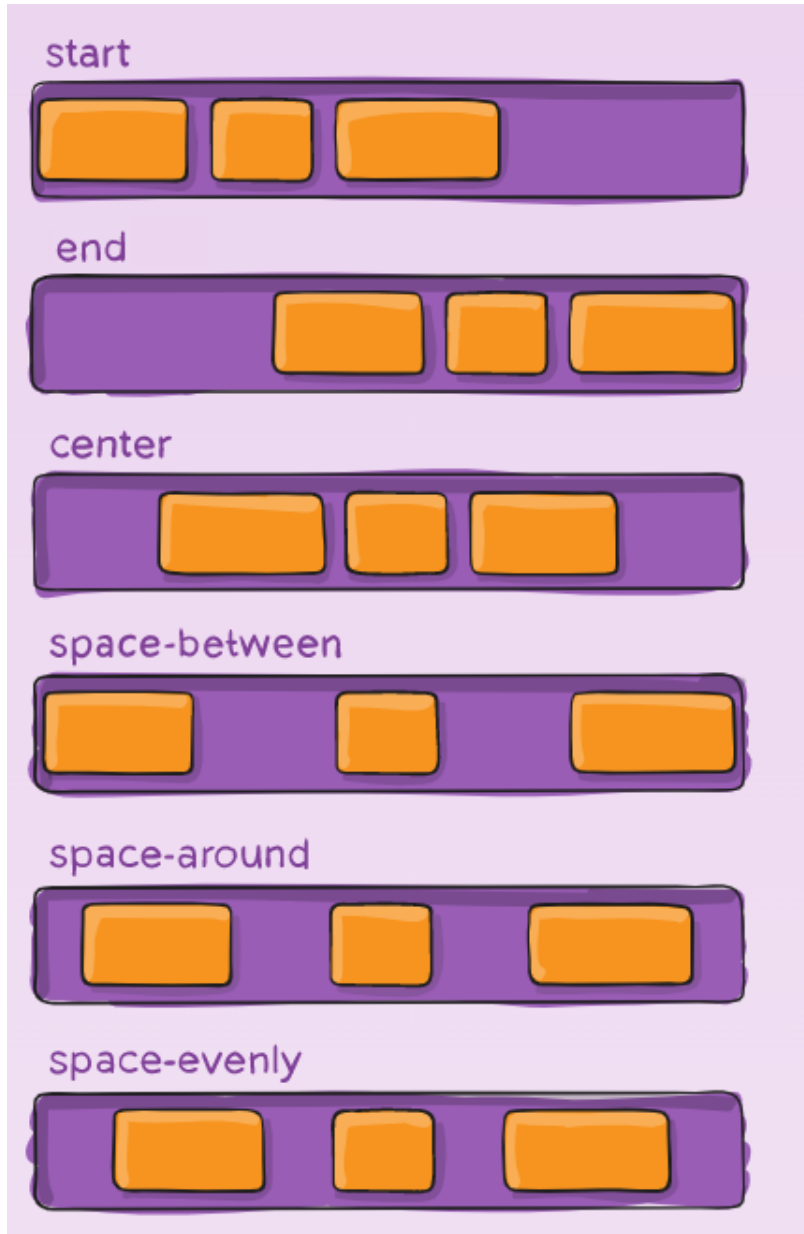


- **nowrap** (default): all flex items will be on one line
- **wrap**: flex items will wrap onto multiple lines



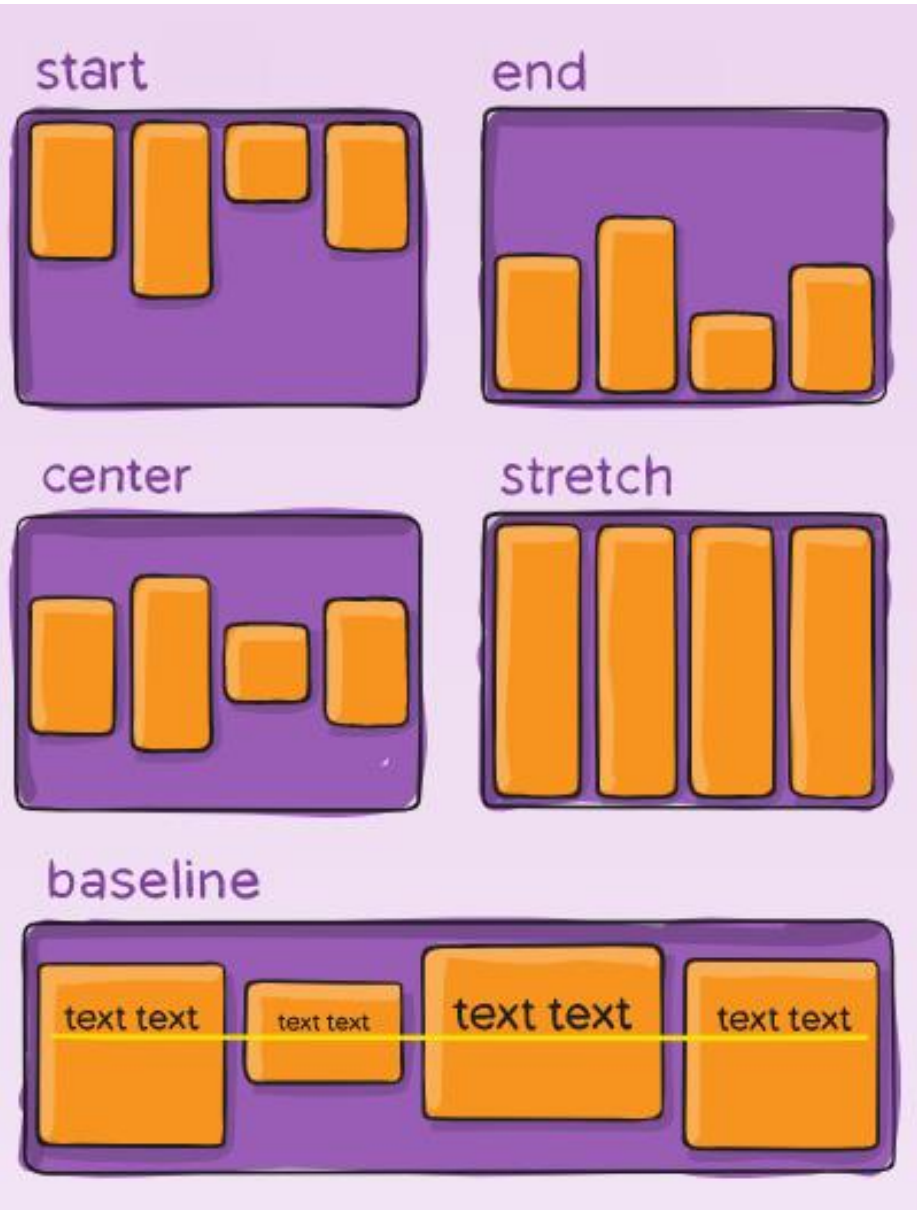


# justify-content



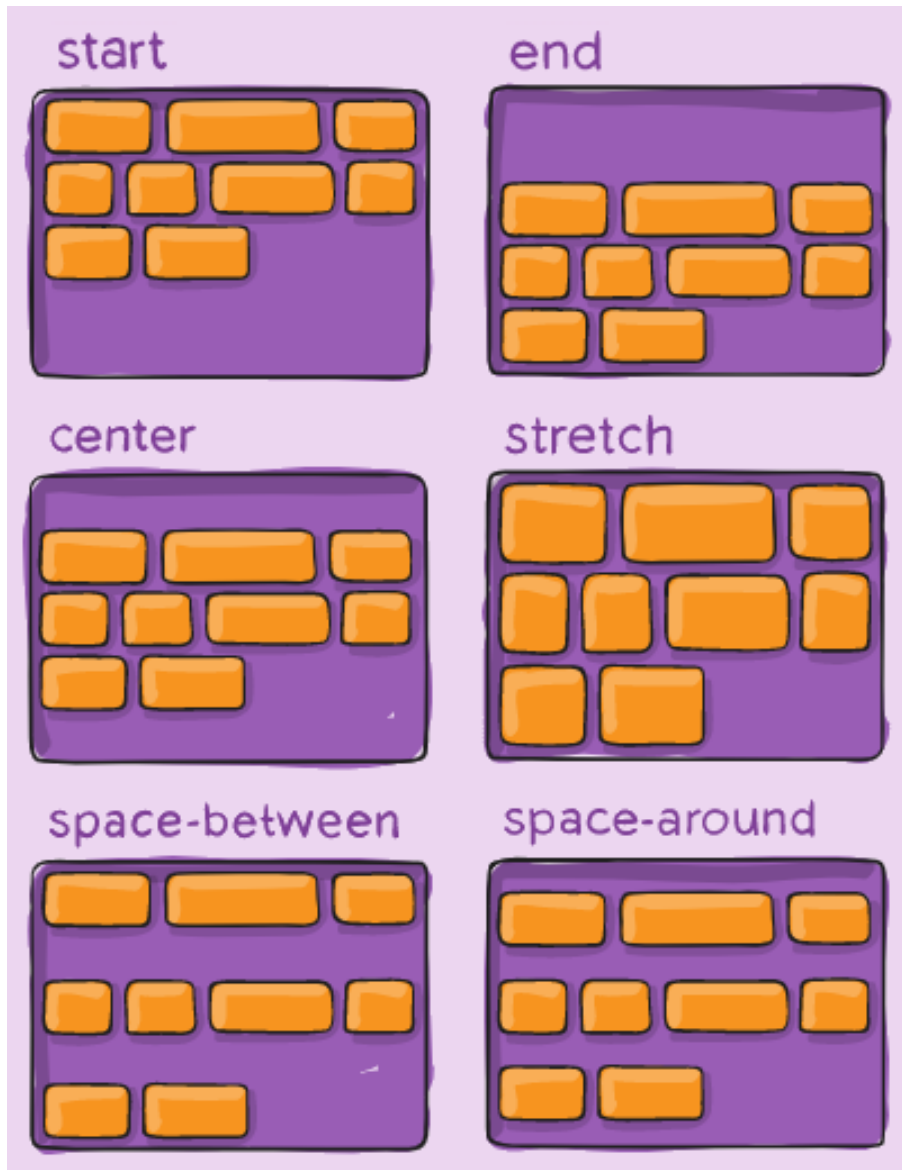
- Align items and distribute extra leftover space along the **main axis**
- **start** is the **default**: items are packed toward the start

# align-items



- Aligns items within a flex line, along the cross-axis
- stretch** is the **default**: flex items stretch to fill the flex line

# align-content



- Aligns and distributes extra leftover free space **between the lines** when items wrap
- **stretch** is the **default**: lines stretch to fill the container

# flex items - order & flex-basis

**order:** changes the order of flex items.


```
.item {  
  order: 3 // the default is 0  
}
```



**order:** changes the display order of the flex item

**flex-basis:** defines the flex item default size before remaining space is distributed. It accepts:

- specific values : pixels, rem, %
- auto: defaults to width or height property
- content : automatic sizing based on its content



first item 20%, second item 40%

# flex items - grow & shrink

**flex-grow:** allows item to grow using remaining space.

`.item-1 { flex-grow: 0; }`    `.item-1 { flex-grow: 1; }`

//default



**Tip:** If all items have flex-grow: 1, the remaining space is distributed equally.

**flex-grow:** determines how the flex item is allowed to grow

**flex-shrink:** defines the ability for a flex item to shrink.

`.one { flex-shrink: 1; }`  
`.two { flex-shrink: 2; }`  
`.three { flex-shrink: 3; }`  
`.four { flex-shrink: 4; }`

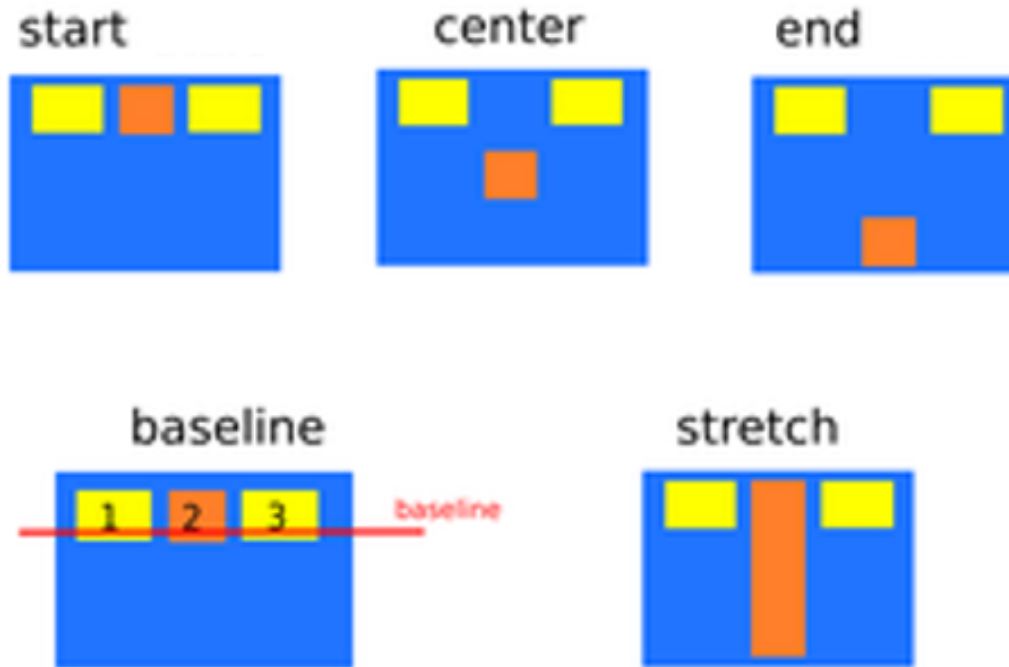


**Tip:** Defaults to 1. The highest the value the more it shrinks compared to siblings.

**flex-shrink:** allows an item to shrink if necessary

# flex items - align-self

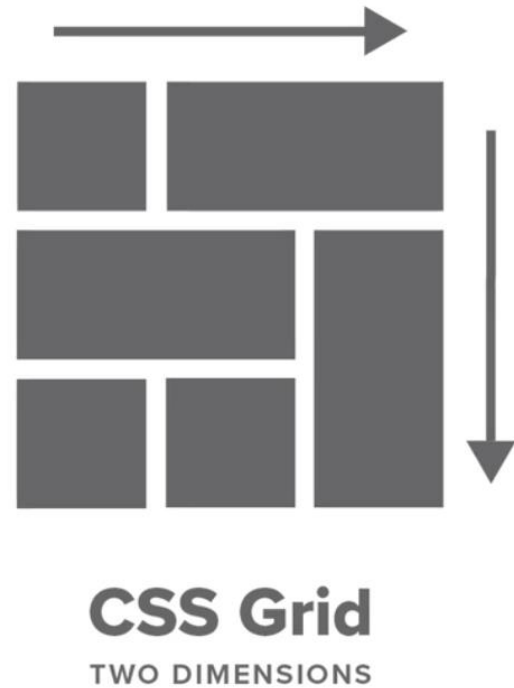
- **align-self**: overrides default alignment (or the one specified by align-items) for a specific item along the Cross Axis





# 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
- Easy control of **space distribution** and **alignment** of items





# Grid container & Grid items

- Grid **container** is defined by setting the *display* property of the container element to *grid*
- Grid item = *Element that is a direct descendant of the grid container*

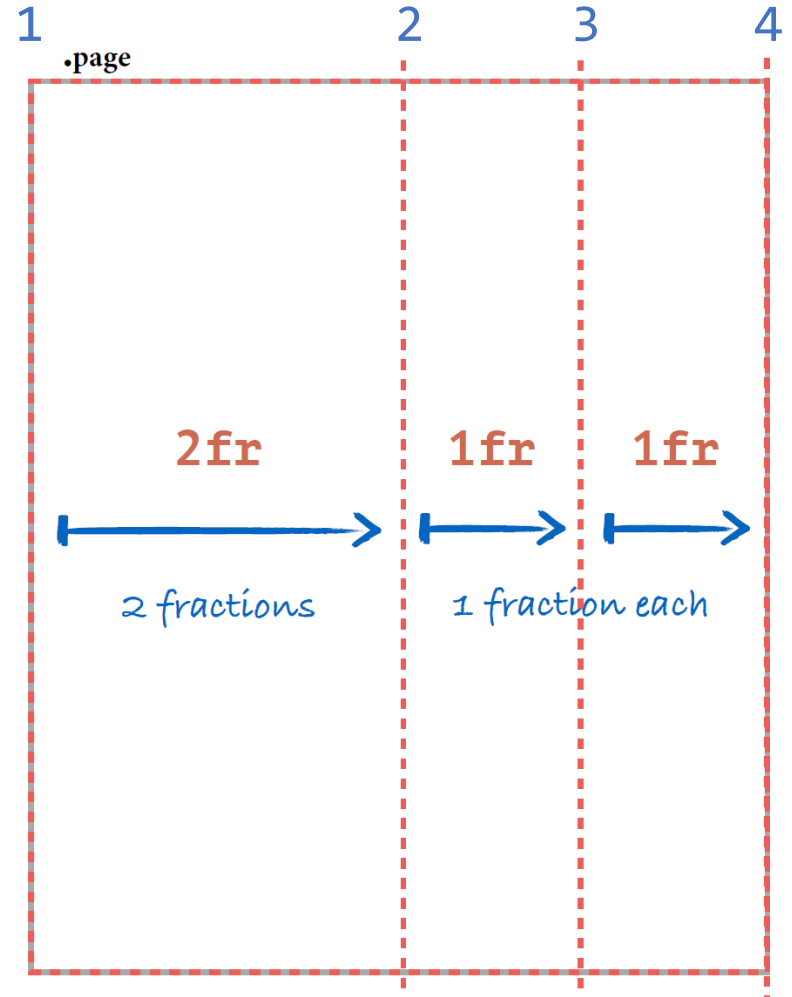
```
.page {  
    display: grid;  
}
```

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

# Grid Template Columns

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

Defines **grid columns** and their desired **size** (em, px, %, **fr**)

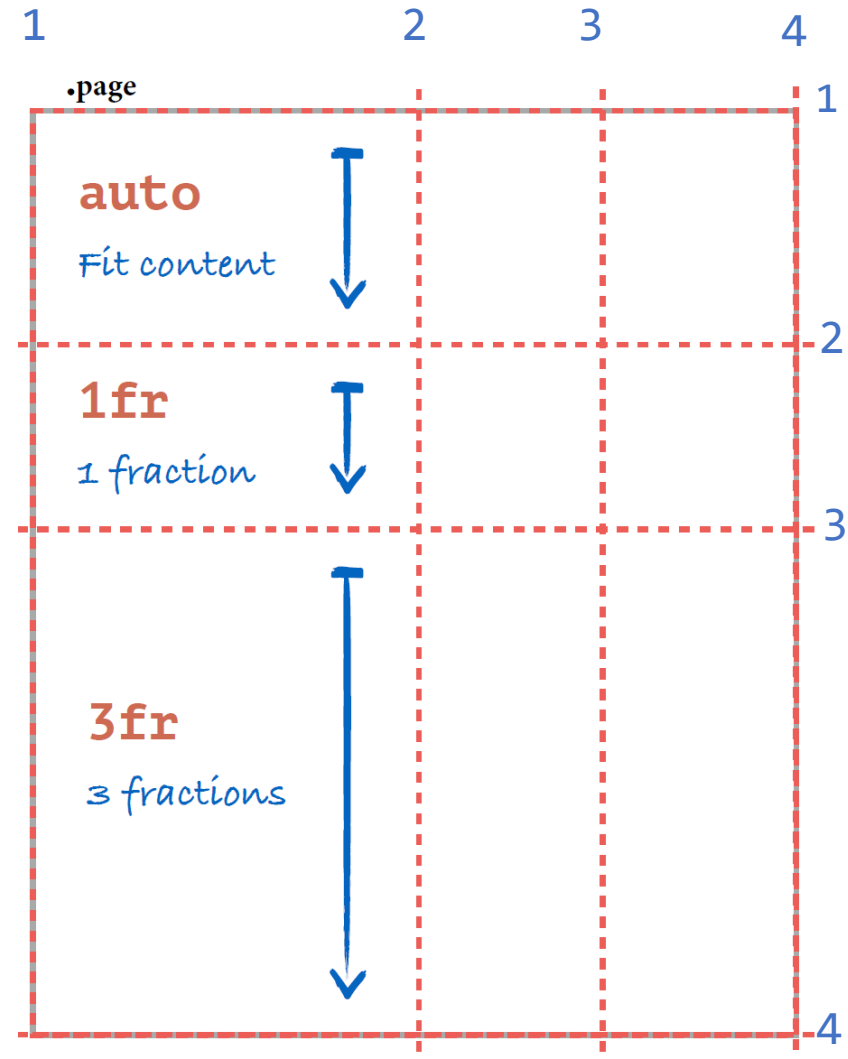


# Grid rows

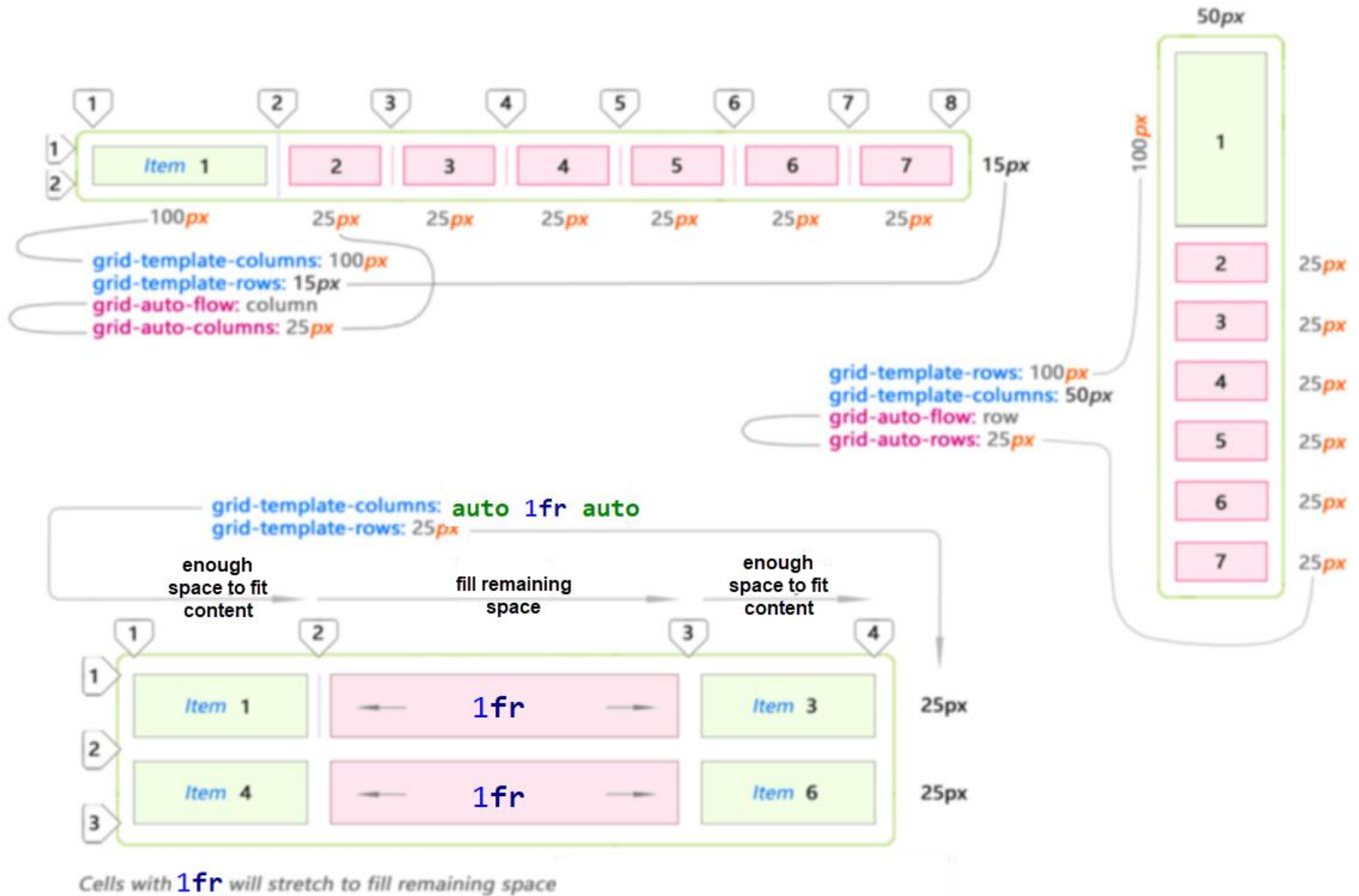
`grid-template-rows:`

`auto 1fr 3fr;`

- Defines **grid rows** and their desired **size** (em, px, %, **fr**)
- Optional, only define it when really needed



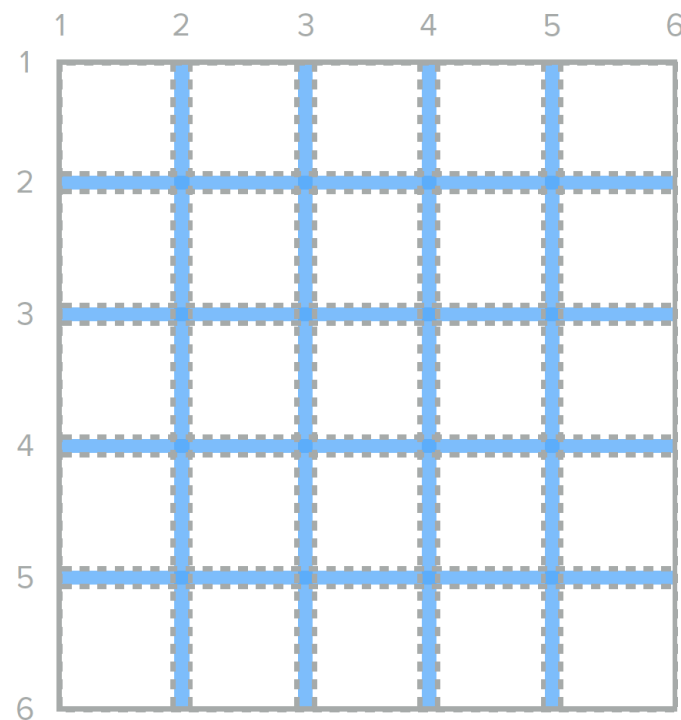
# grid-template-rows & grid-template-columns



# grid-gap

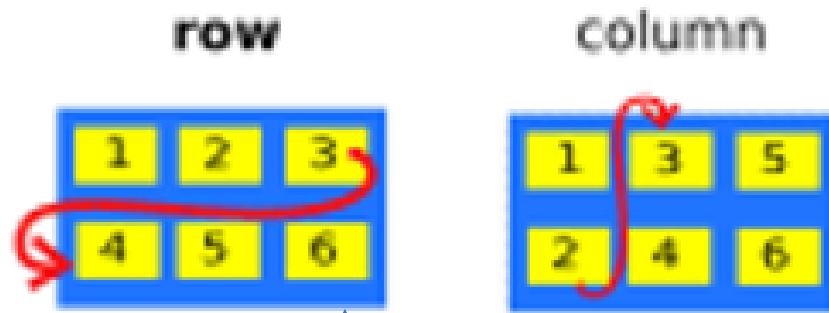
```
.page {  
  display: grid;  
  grid-gap: .5rem;  
}
```

Defines space (i.e., gutter) between grid tracks (as shown in **blue**)



# grid-auto-flow

Defines how to automatically place grid items that aren't explicitly placed (**row** if the **default**)



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;
```

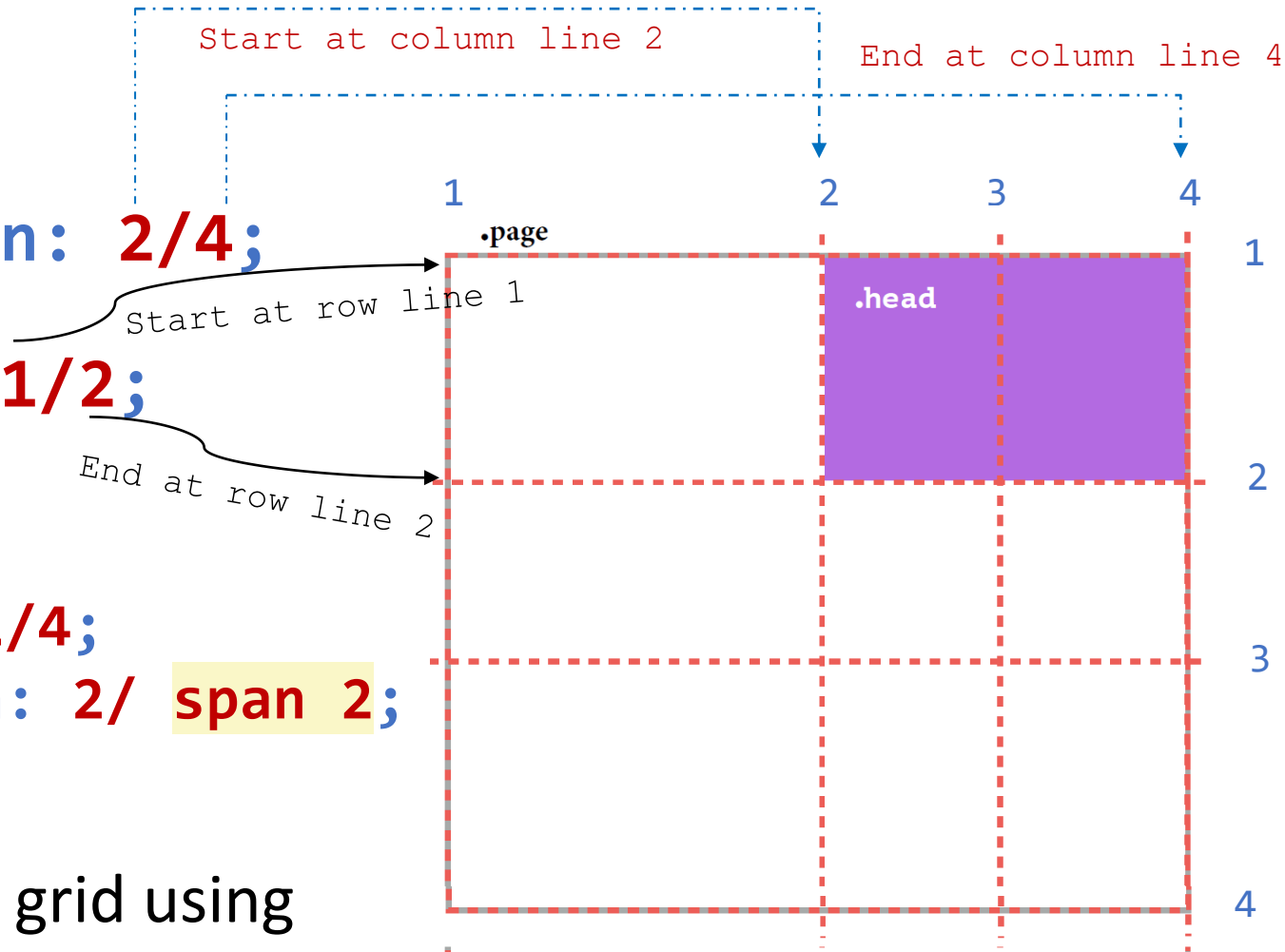
```
  grid-row: 1/2;
```

```
}
```

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

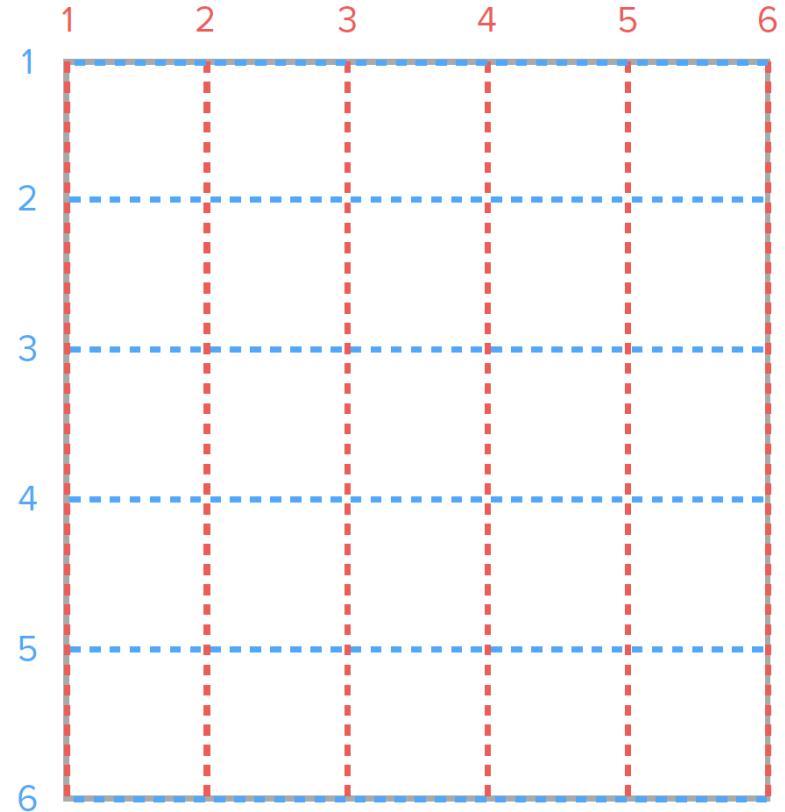
```
Or grid-column: 2/ span 2;
```

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 - Placing Items using Grid Lines

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

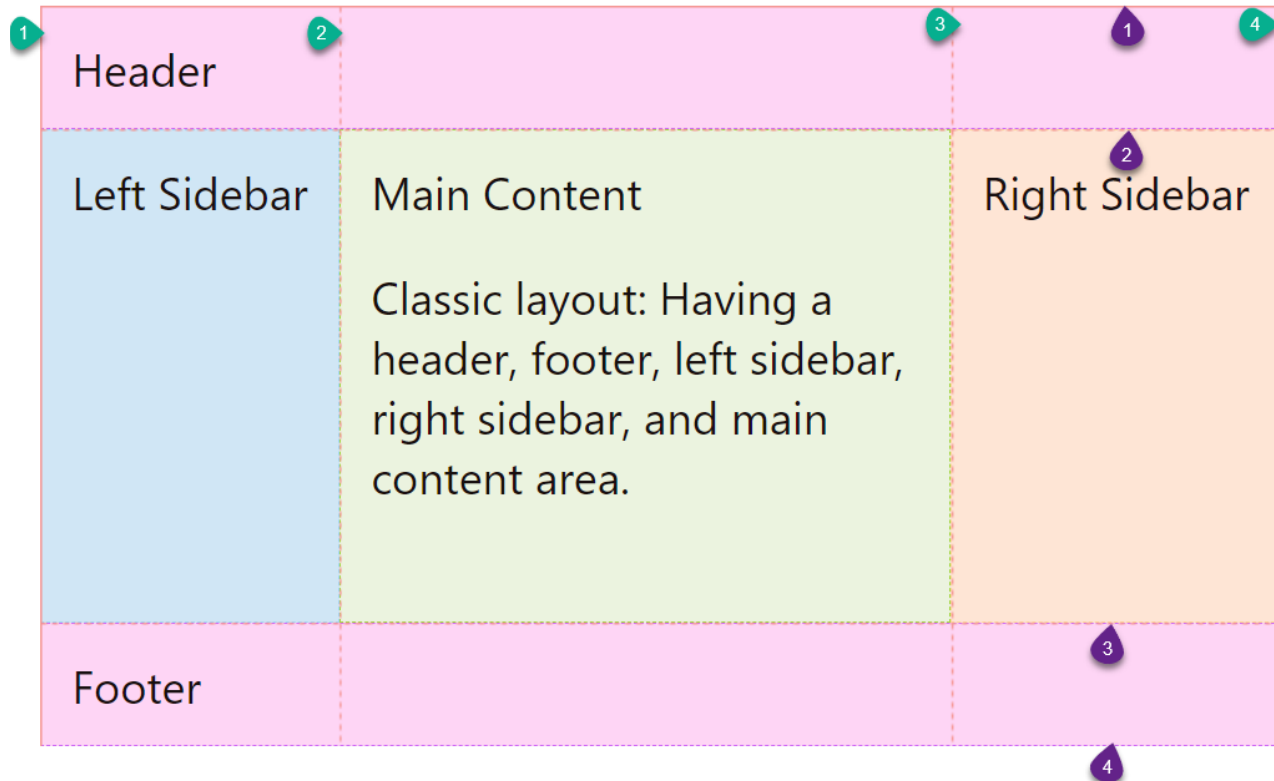
```
header {  
  grid-column: 1 / span 3;  
}
```

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

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

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

```
footer {  
  grid-column: 1 / span 3;  
}
```

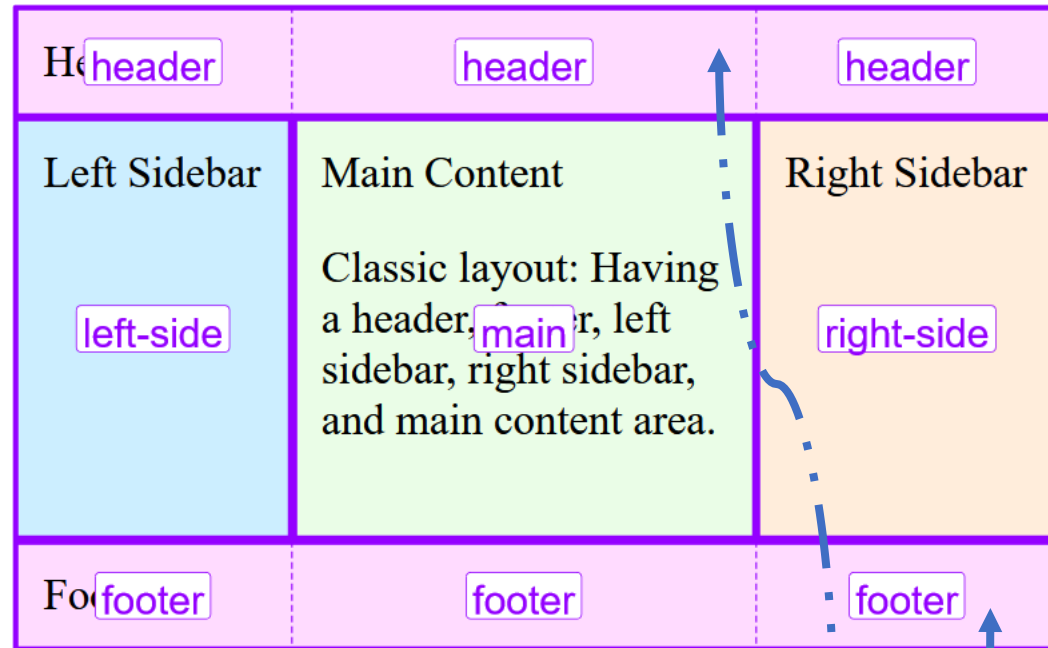




# Placing Items using Grid areas

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

Then place items in the grid areas

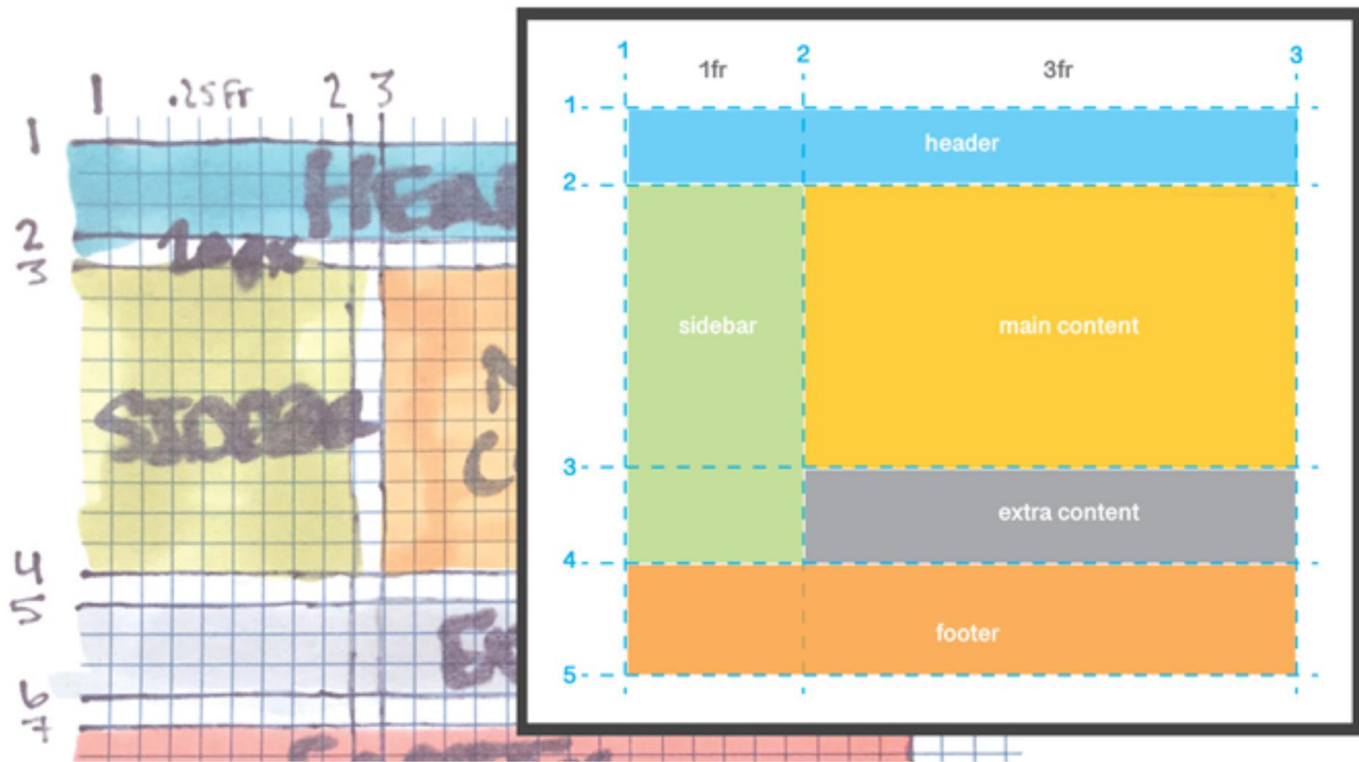


```
.container {  
  display: grid;  
  grid-template: auto 1fr auto  
    / auto 1fr auto;  
  grid-template-areas:  
    "header header header"  
    "left-side main right-side"  
    "footer footer footer";  
}
```

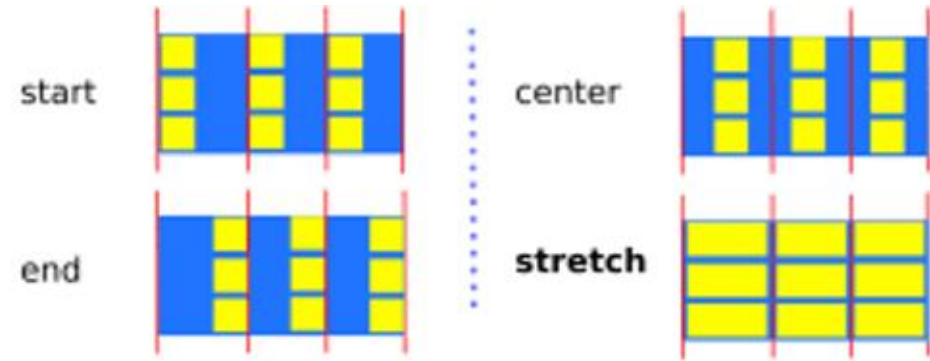
```
header {  
  grid-area: header;  
}  
  
.left-side {  
  grid-area: left-side;  
}  
  
main {  
  grid-area: main;  
}  
  
.right-side {  
  grid-area: right-side;  
}  
  
footer {  
  grid-area: footer;  
}
```

# Grid areas

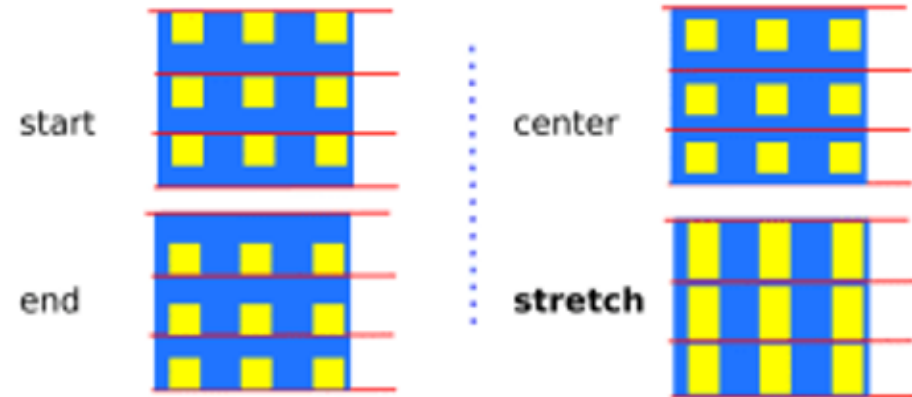
- Defining grid areas and using them to place elements is **best way** to design the page layout as it allows direct translation of the paper-based design to a CSS grid



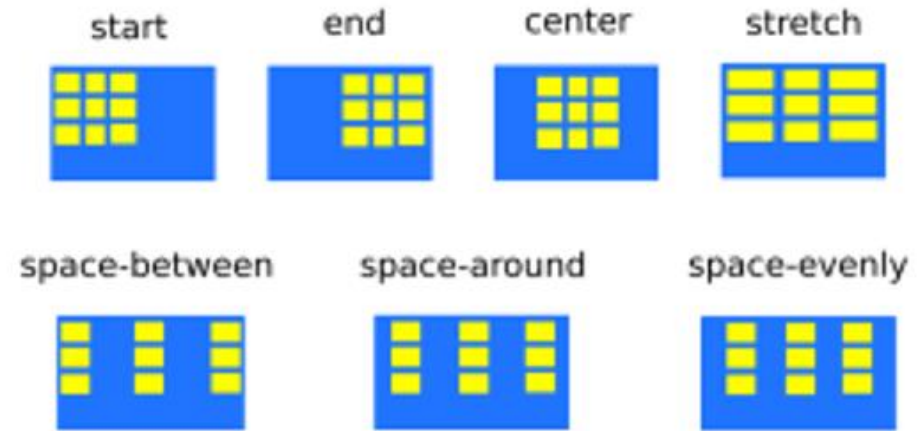
- **justify-items**  
defines alignment along the **row axis**



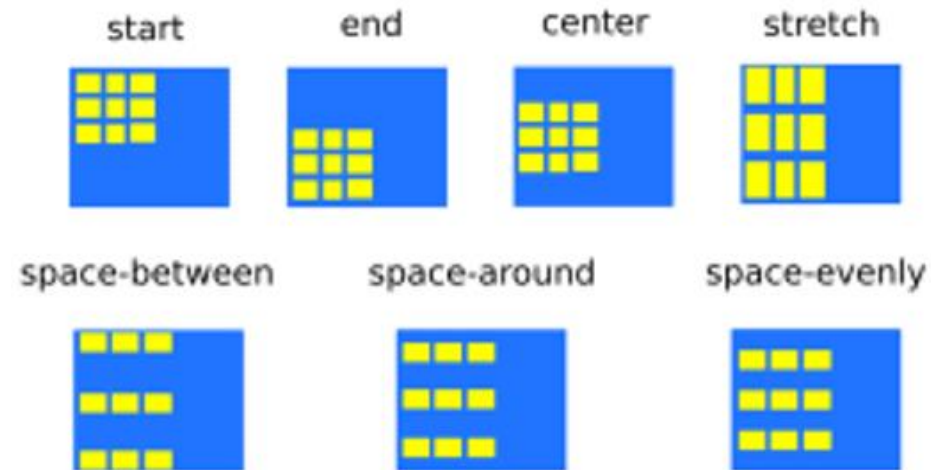
- **align-items**  
defines alignment along the **column axis**



- **justify-content**  
justifies **all** grid content  
on **row axis** (if container has  
extra space)

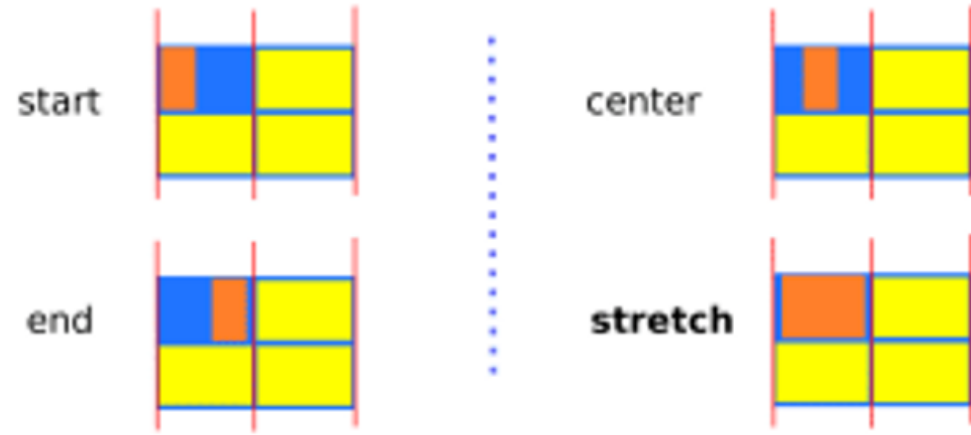


- **align-content**  
justifies **all** grid content  
on **column axis** (if container  
has extra space)



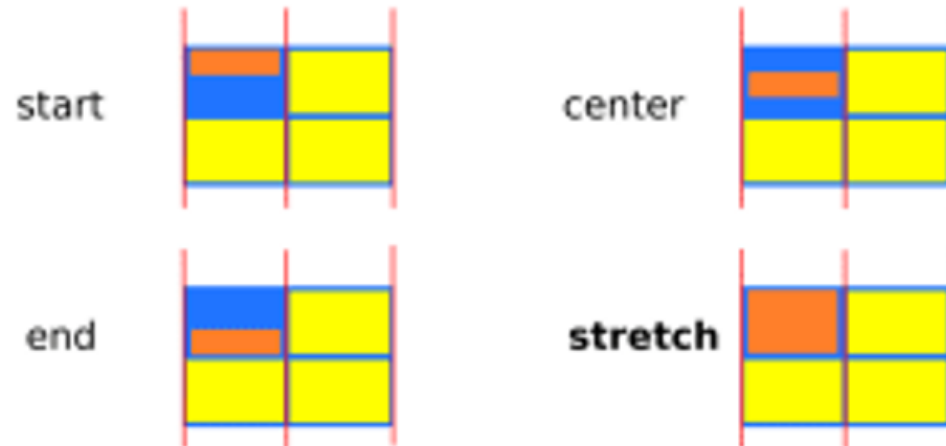
- **justify-self**

aligns **an item** inside a single cell along the **row axis**



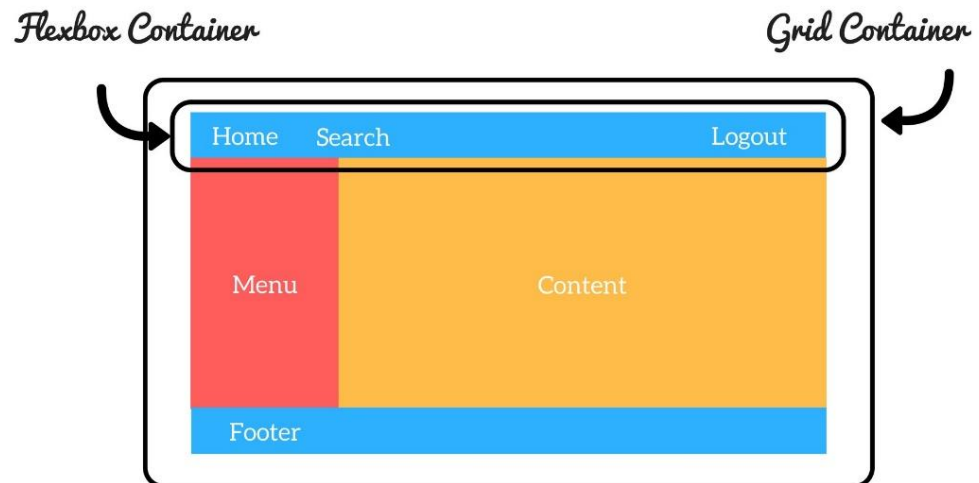
- **align-self**

aligns an item inside a single cell along the **column axis**



# Grid vs Flexbox

- Grid allows defining a **two-dimensional** layout with columns and rows, unlike flexbox which is a **one-dimensional layout** (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

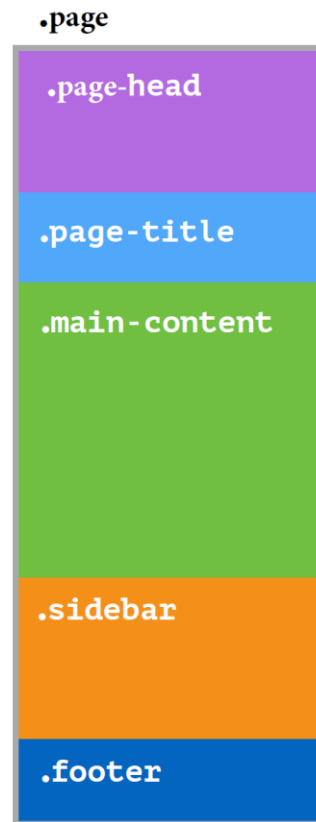
# Responsive page layout using Media Queries

Use media queries to define layouts for different screen sizes

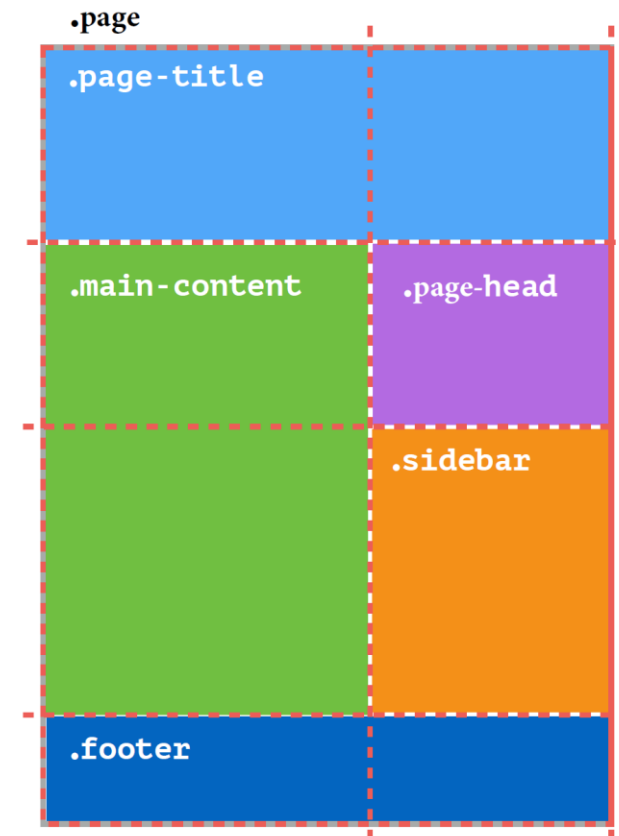
```
@media screen and (min-width: 700px) {  
  .page {  
    display: grid;  
    grid-template-columns: 2fr 1fr;  
    grid-template-areas: "title title"  
                        "main header"  
                        "main sidebar"  
                        "footer footer";  
  }  
}
```

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

No grid

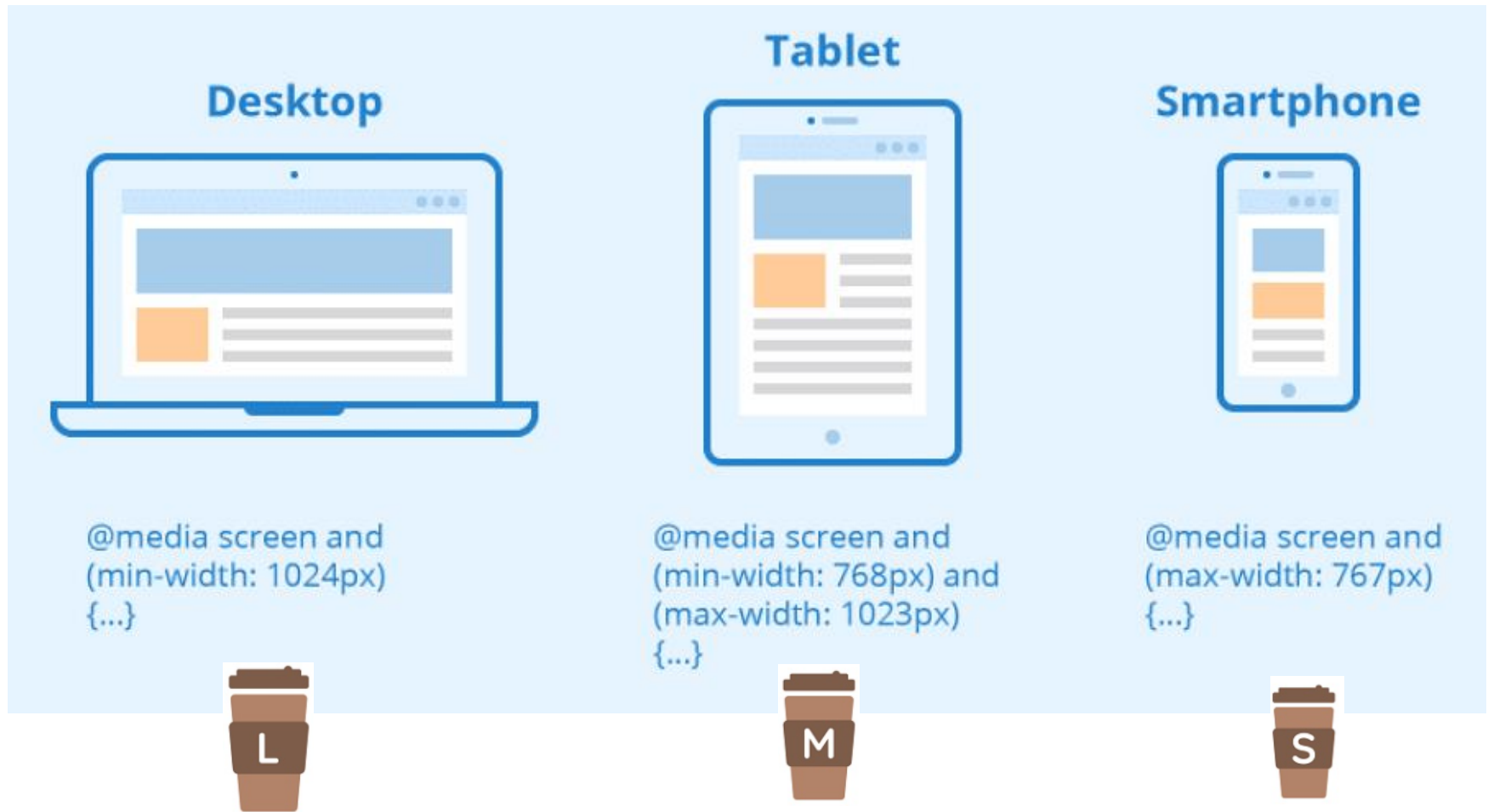


Two-column grid  
(when page width  $\geq 700px$ )





# Common breakpoints

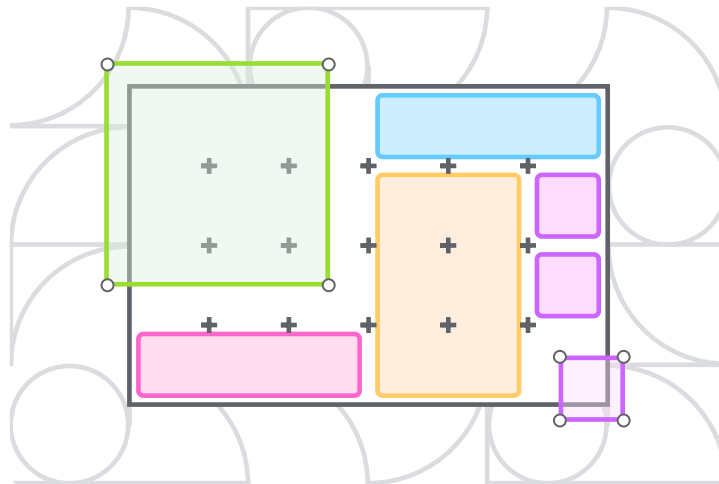


Source: <https://kinsta.com/blog/responsive-web-design/>

# Common Layout Patterns

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

Watch explanation in this [video](#)



# Menu using a flexbox

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

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

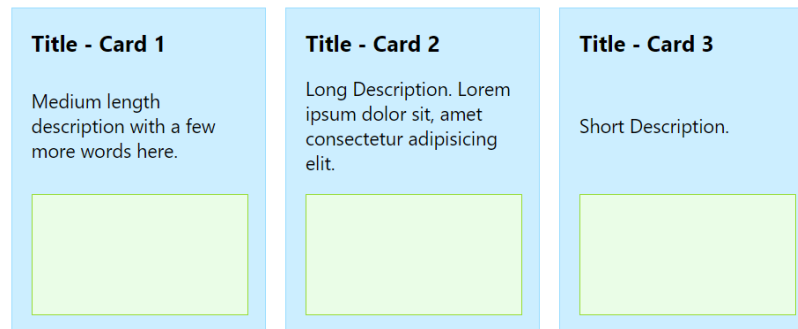
```
<nav>
  <ul>
    <li><a href="#">Home</a></li>
    <li><a href="#">About</a></li>
    <li><a href="#">Contact us</a></li>
  </ul>
</nav>
```

```
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 edge



# 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;  
}
```

**Doha, Qatar**



Doha is Qatar's largest city and commercial centre. It has a population of 2.4 million.

[Read more...](#)

# Clamping card

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

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

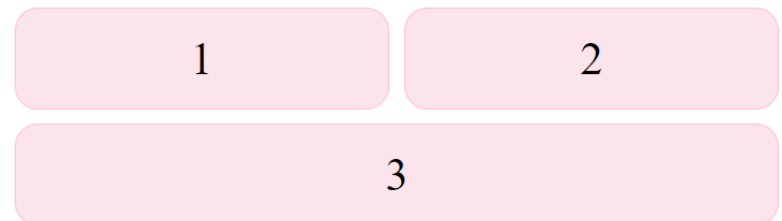
```
.card {  
    width: clamp(23ch, 40%, 46ch);  
}
```

- 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 boxes wrap to the next line to maintain the minimum base-width



# Pancake stack – Header-Main-Footer

`grid-template-rows: auto 1fr auto`

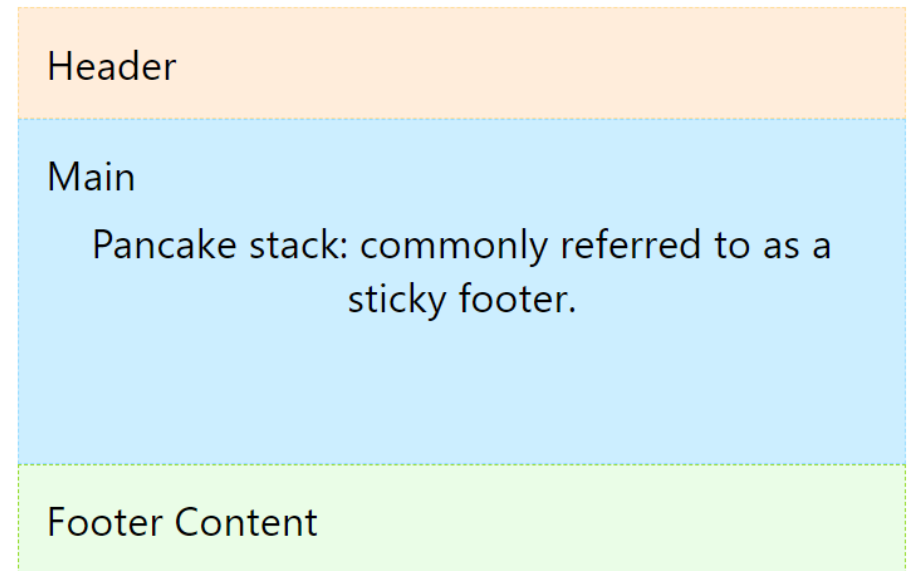
- Commonly referred to as a sticky footer

`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 & Content

**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;**

Min:  
100px  
/ Max:  
20%

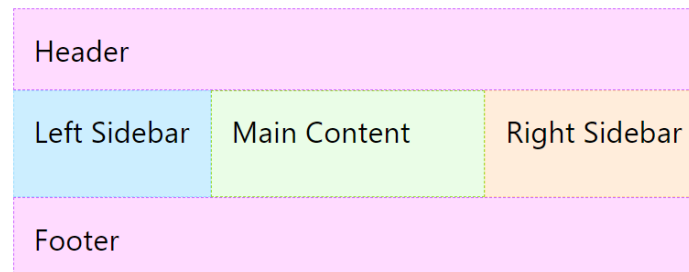
This main element takes the second grid position (1fr), meaning it takes up the rest of the remaining space.

- **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 – Header-3 Columns-Footer

`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 contentheader, 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**

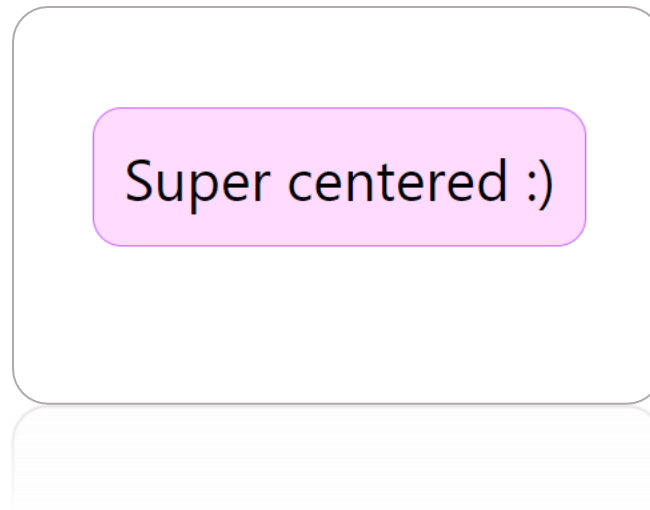


[See posted example](#)



# 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 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://developer.mozilla.org/en-US/docs/Web/CSS/CSS_Grid_Layout)
  - <https://gridbyexample.com/learn/>
  - <https://css-tricks.com/snippets/css/complete-guide-grid/>