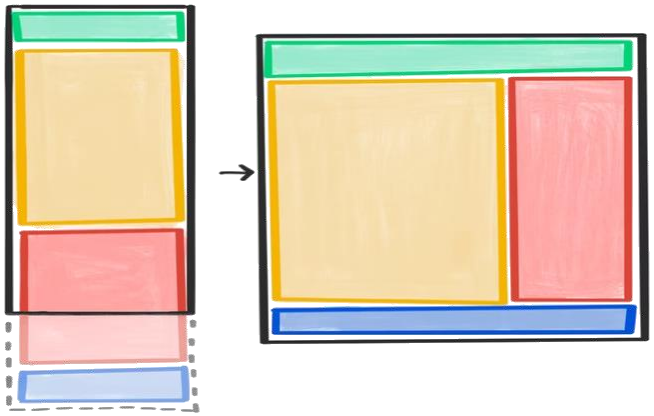
Responsive Web Design

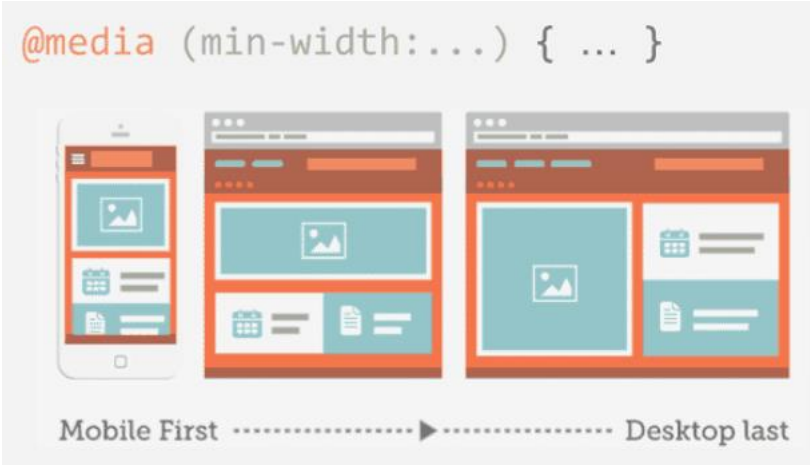
Outline

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

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



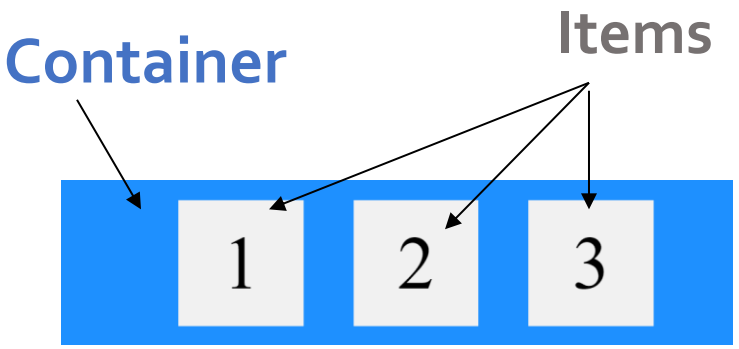



CSS
3
Flexbox

Flexbox

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

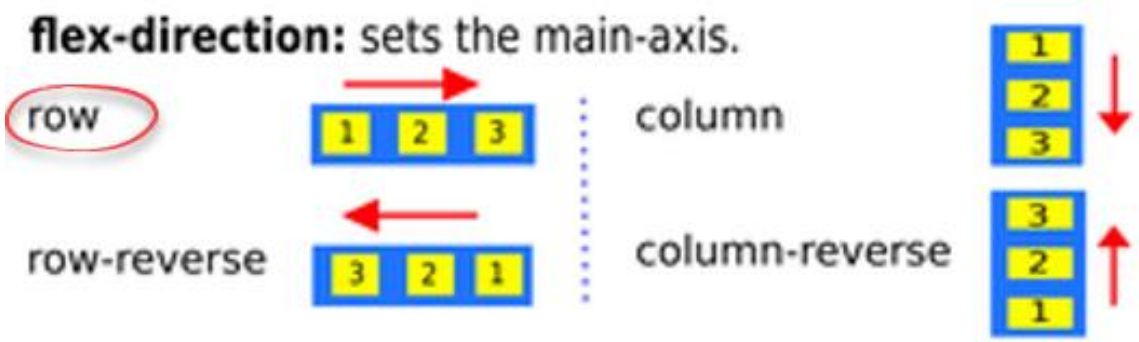
```
.flex-container {
    display: flex;
    gap: 1rem;
    justify-content: center;
}

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



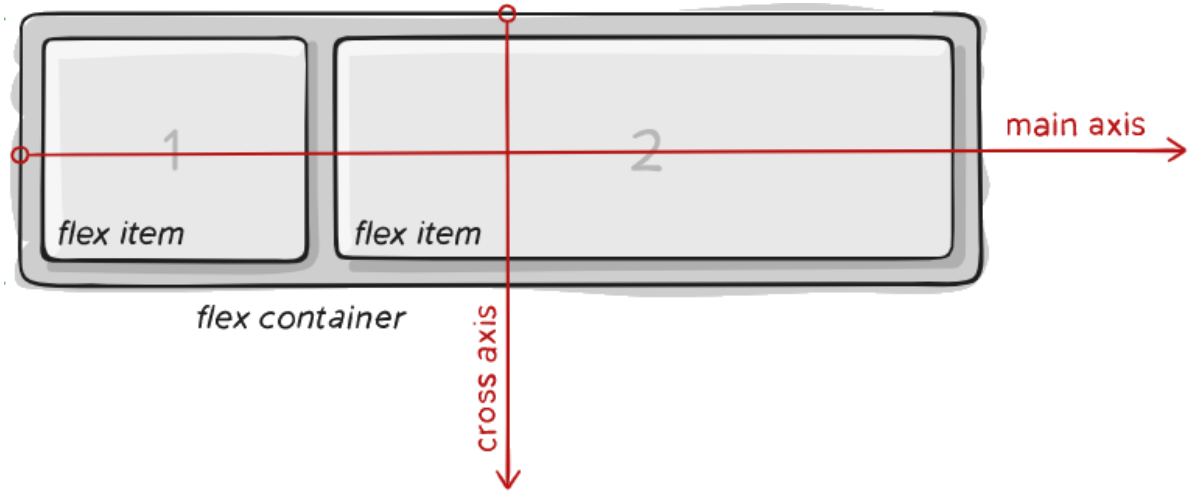
https://www.w3schools.com/css/css3_flexbox.asp

Flex Container Properties

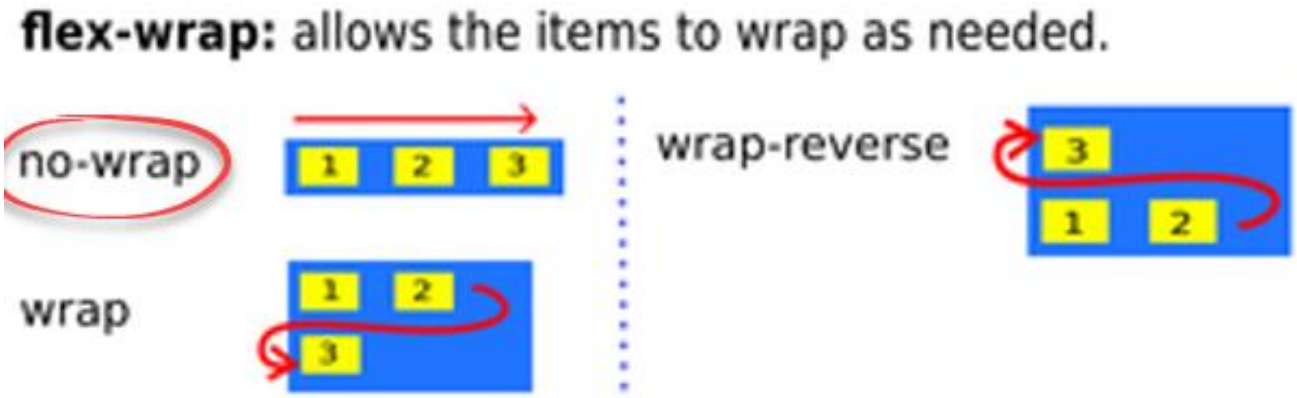
- **flex-direction**: either **row** (default) or column
- **flex-wrap**: **nowrap** (default) all flex items will be on 1 line. Assign wrap to allow flex items to wrap onto multiple lines
- **justify-content**: aligns and arranges flex-items along the main axis
- **align-items**: aligns items within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



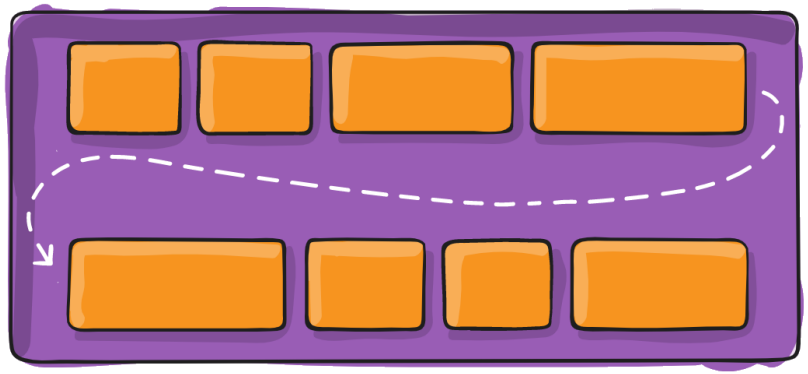
row (default): horizontal alignment



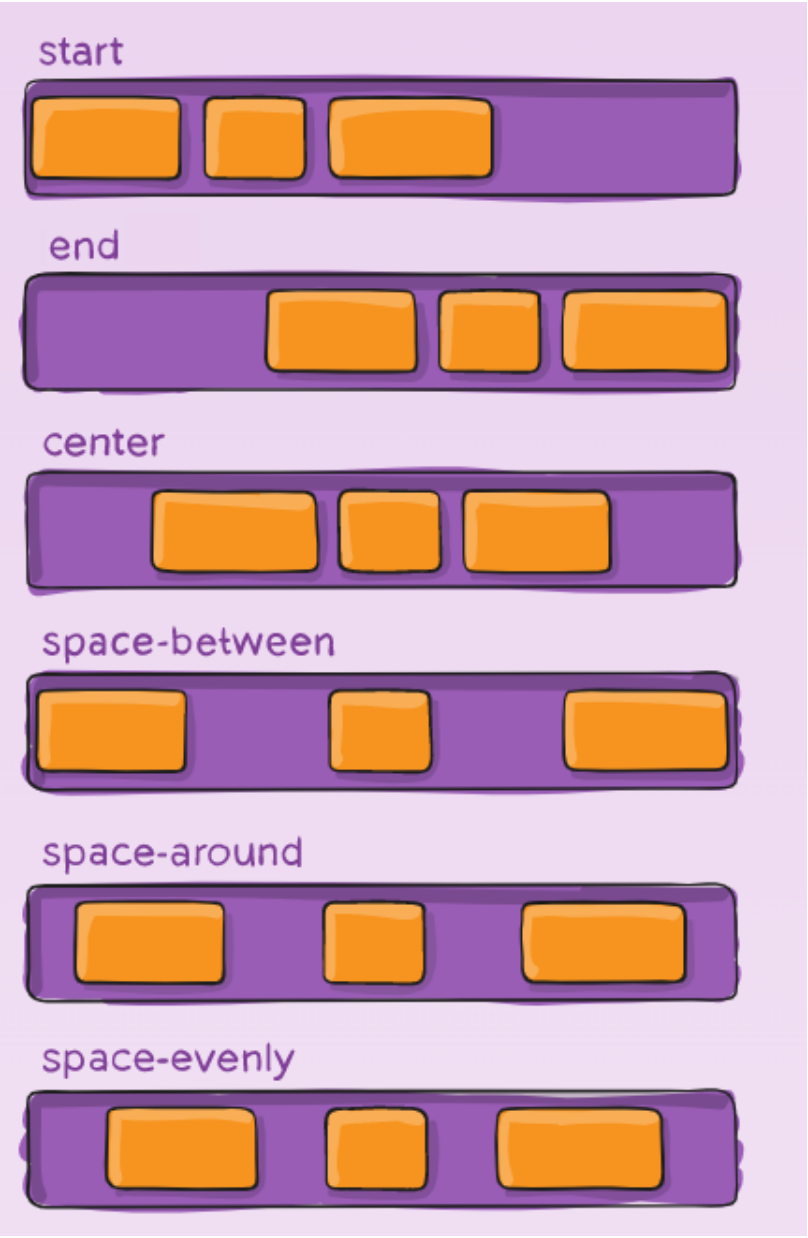
column: vertical alignment



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

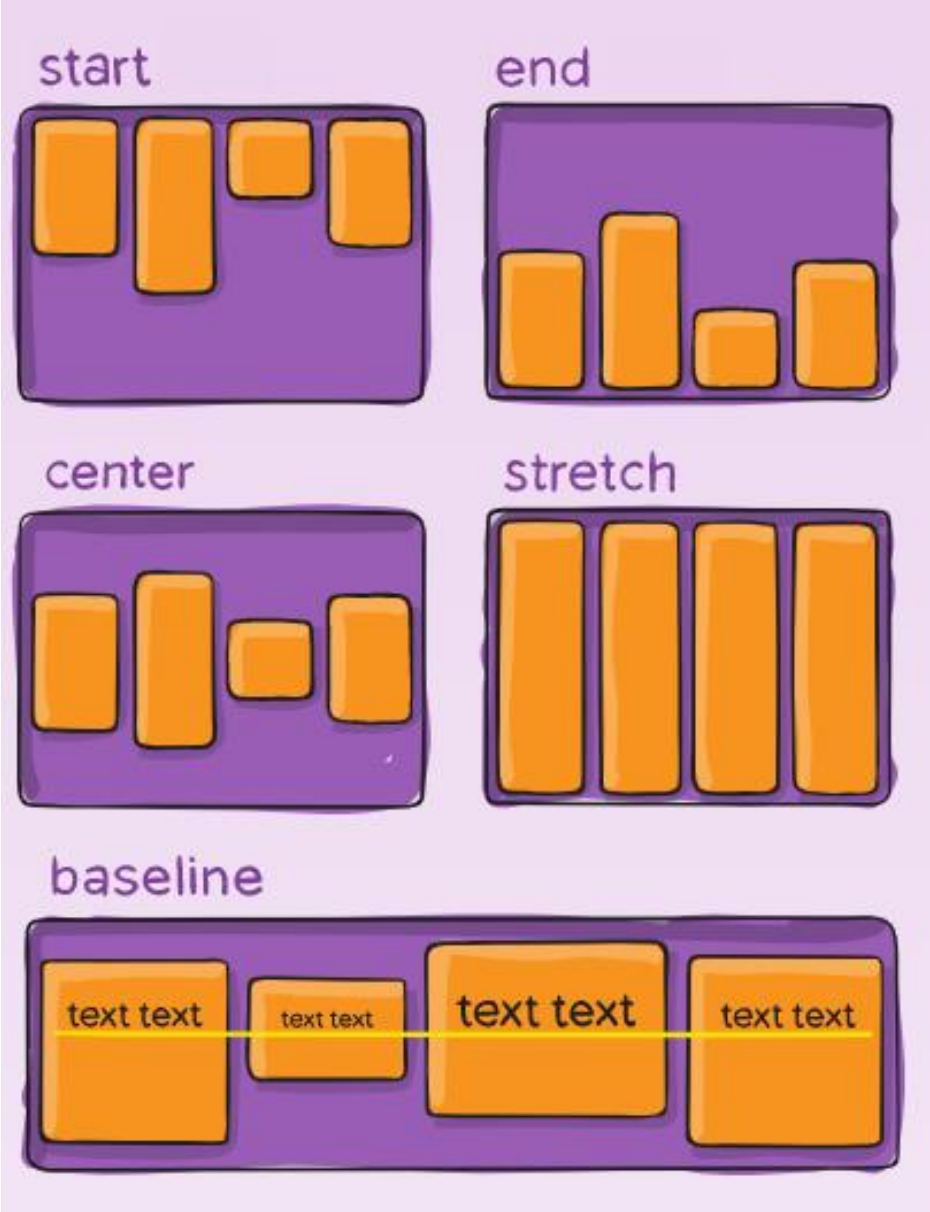


justify-content



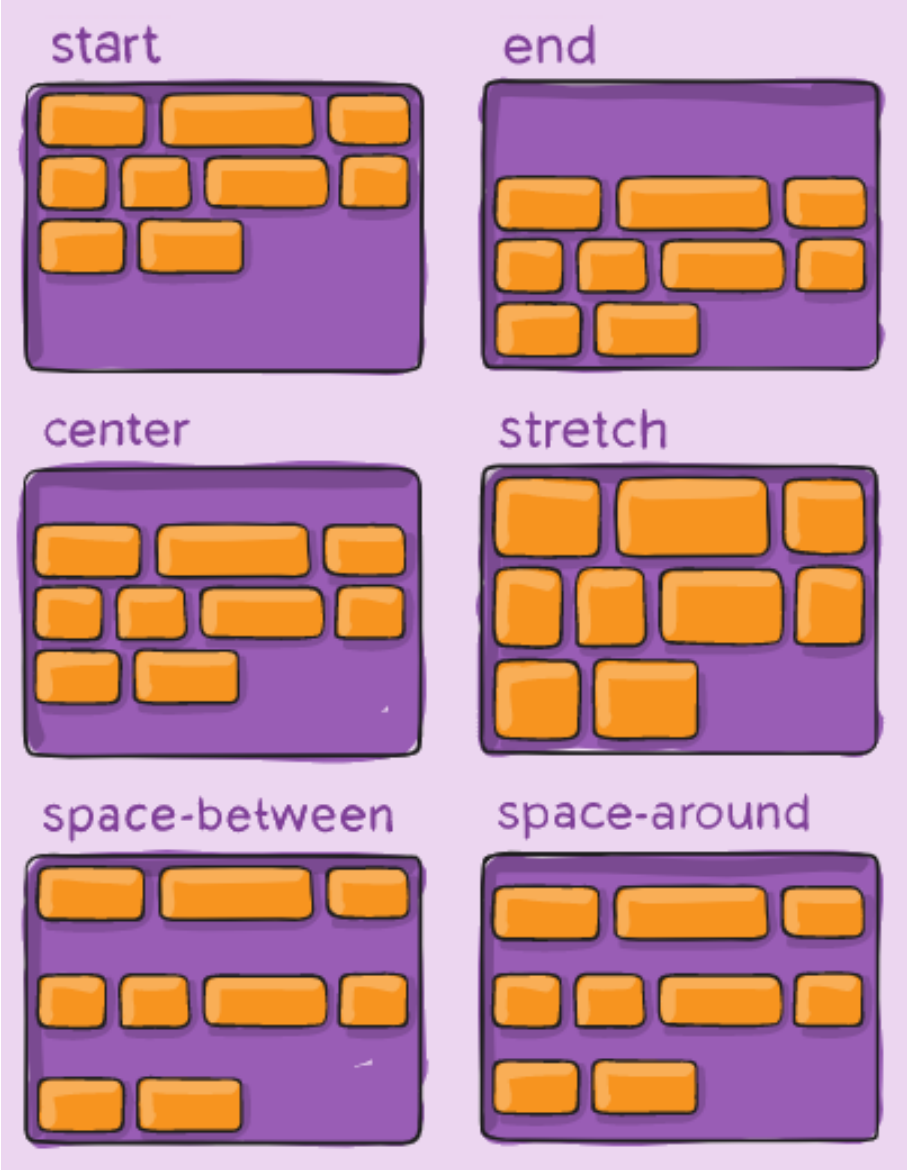
- Align items and distribute extra leftover space along the **main axis**
- **start** is the default: items are packed toward the start

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



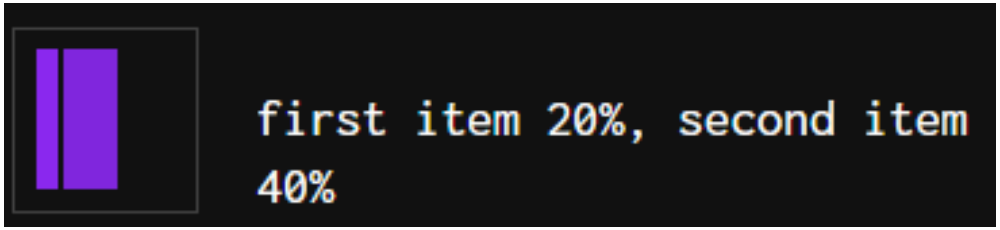
- Aligns and distributes extra leftover free space **between the lines** when items wrap
- **stretch** is the default: lines stretch to fill the container

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

flex items - grow & shrink

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

```
.item-1 { flex-grow: 0}
//default
```


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

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.

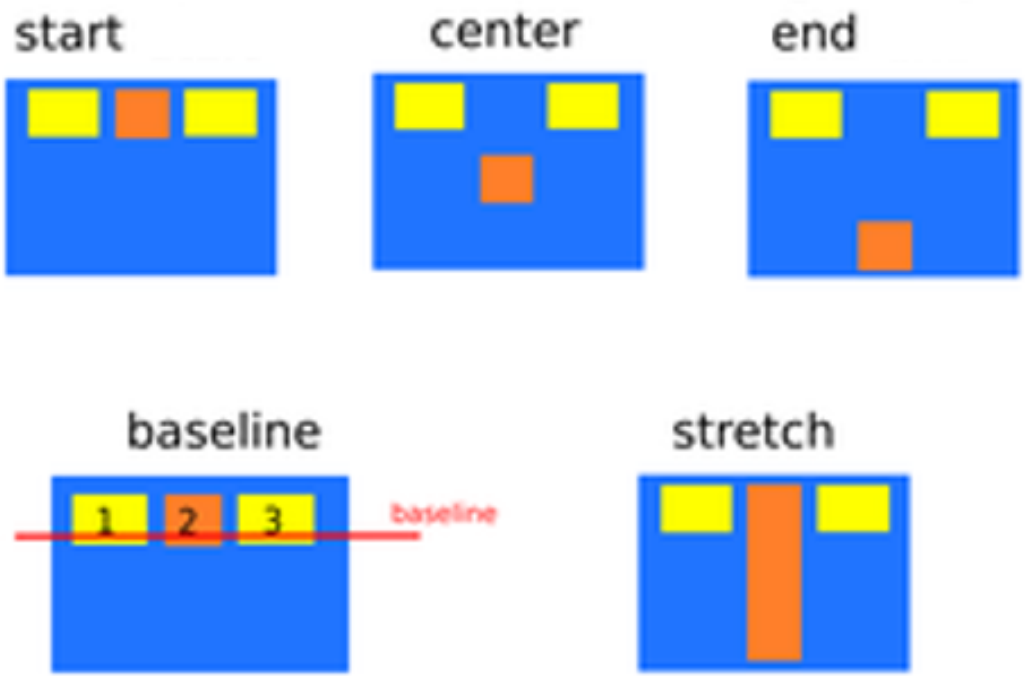
```
.one { flex-shrink: 1; }
.two { flex-shrink: 2; }
.three { flex-shrink: 3; }
.four { flex-shrink: 4; }
```

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
3
Grid

CSS Grid

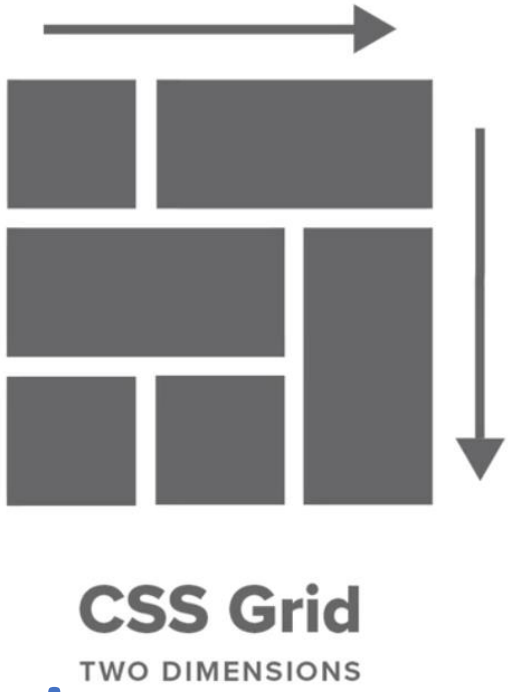
- CSS Grid is a **two-dimensional layout** system to design the page layout
- Can specify columns/rows

template

- Grid elements can be **auto-placed**

or **explicitly placed** using grid lines

or grid areas



- Easy control of **sizing**, **space distribution**

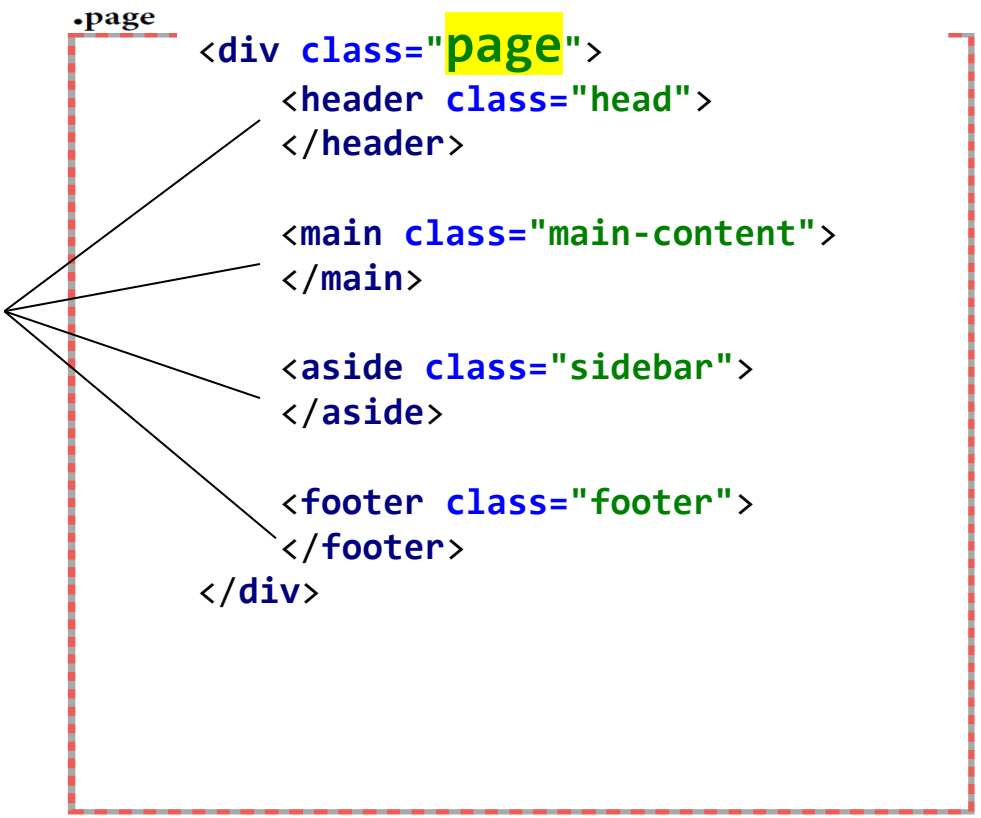
and **alignment** of child elements

Grid **container** & Grid **items**

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

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

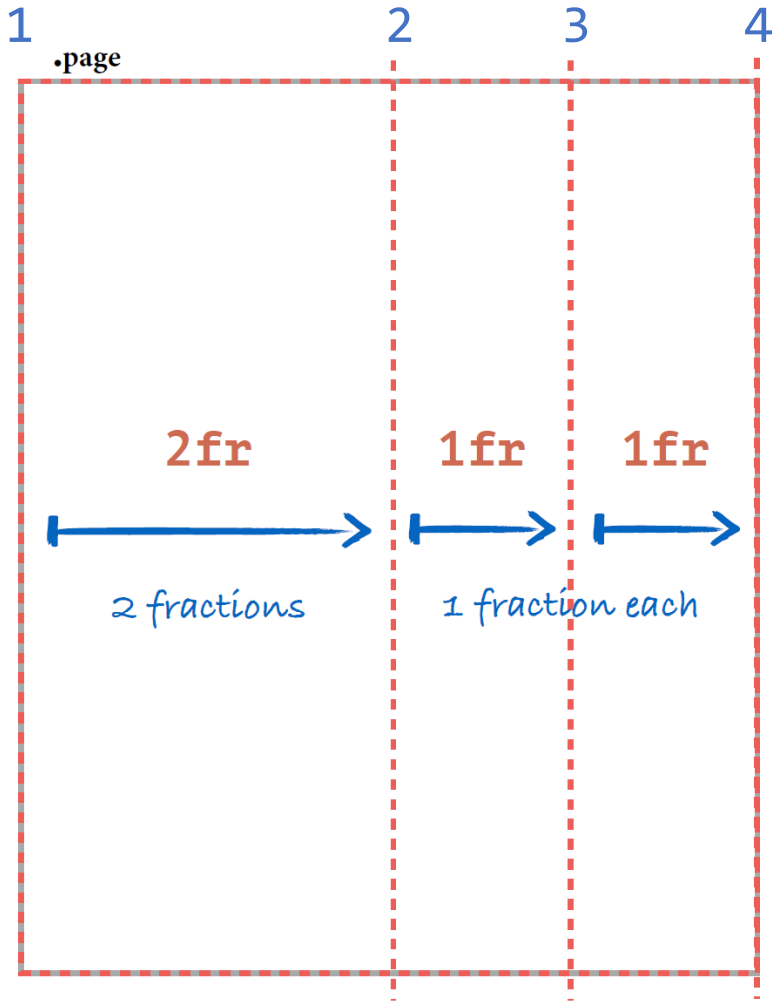
- Grid item = *Element that is a direct descendant of the grid* ***container***



Grid Template Columns

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

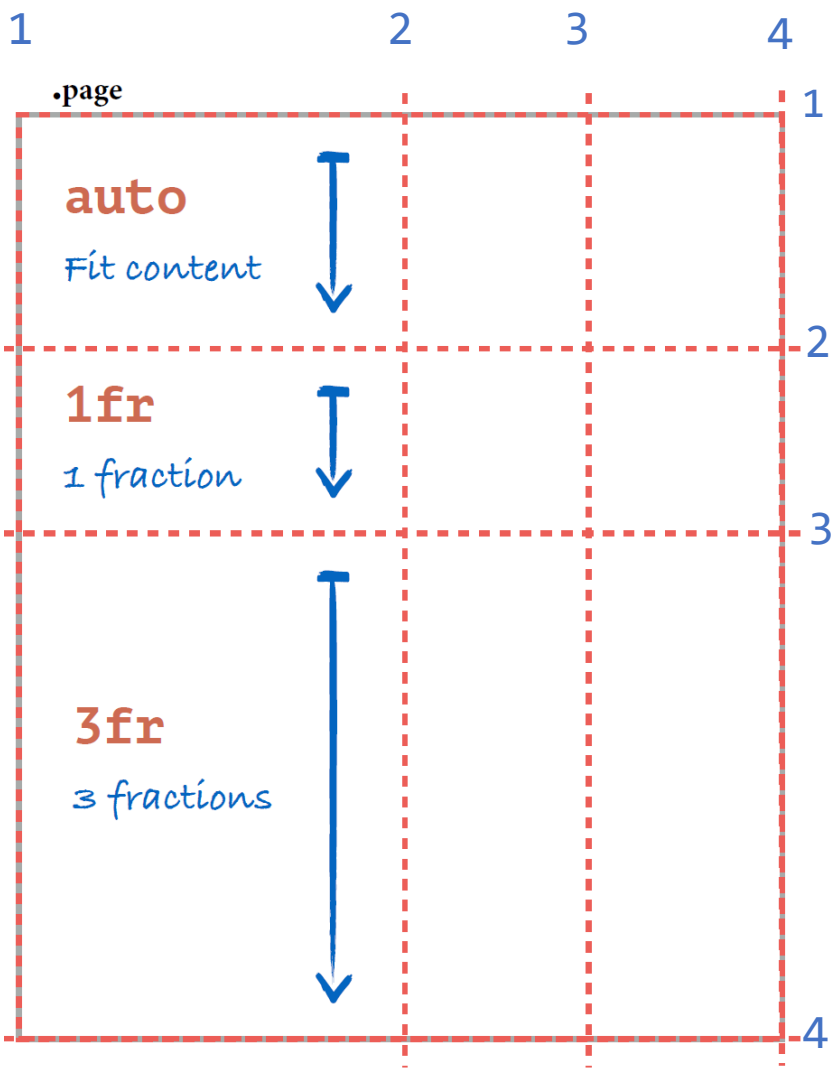
Defines **grid columns** and their desired **size** (em, px, %, **fr**)



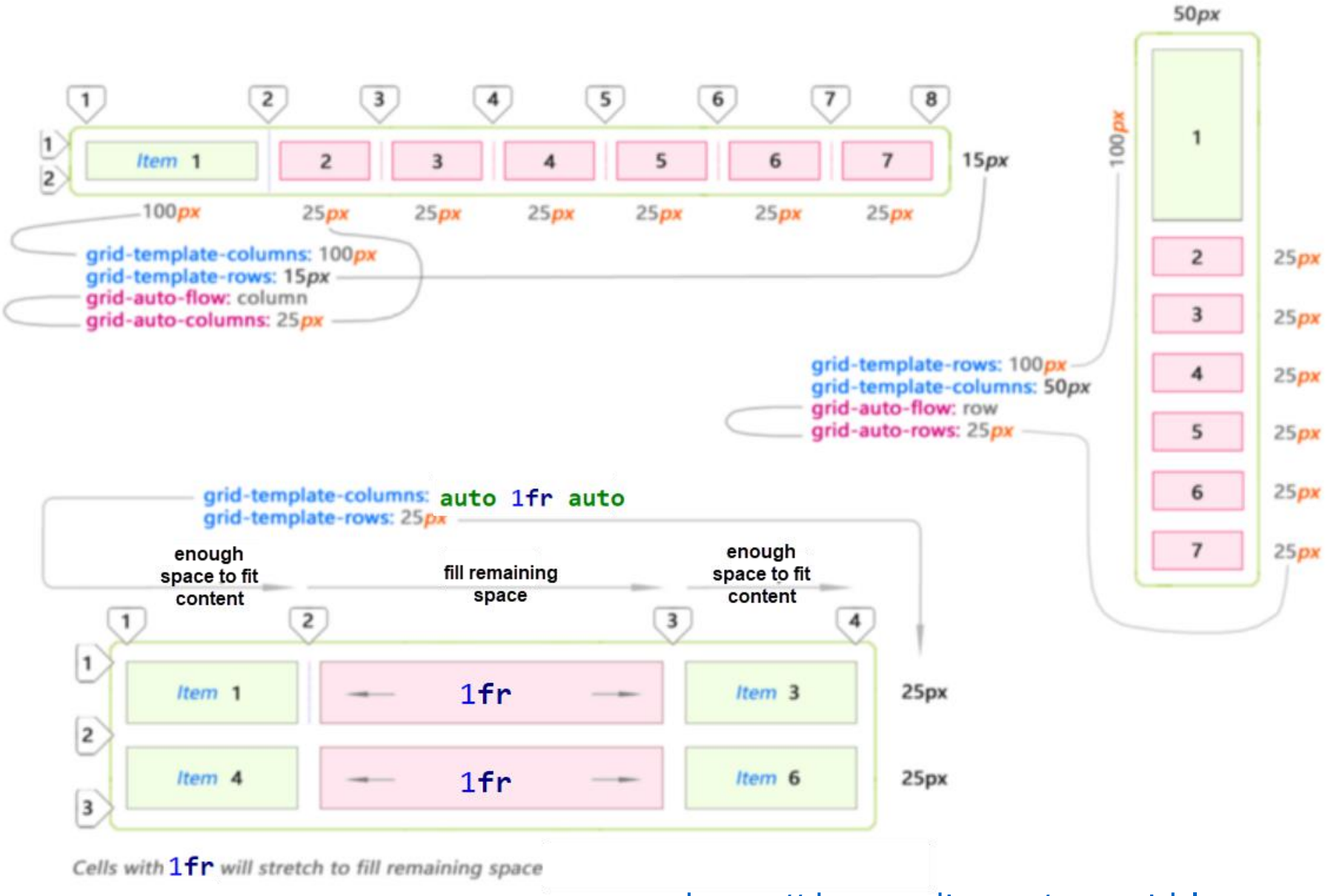
Grid rows

```
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

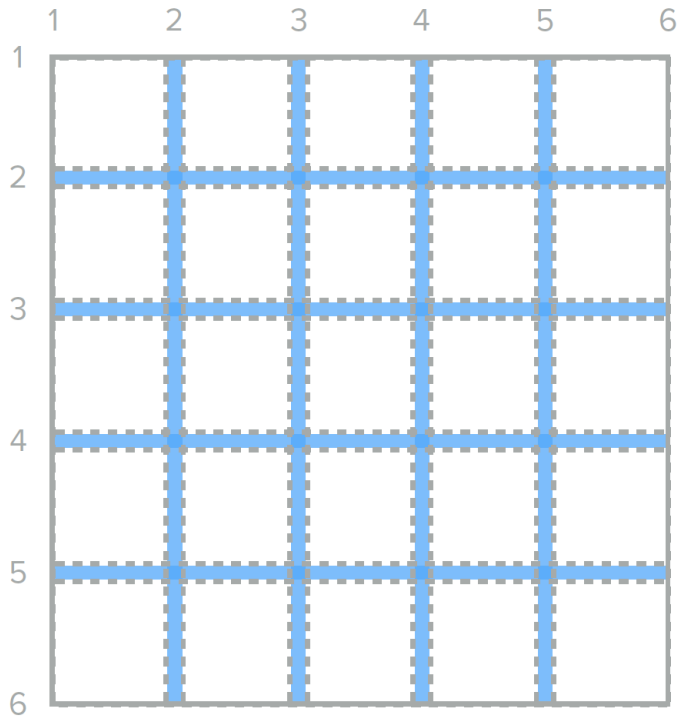


https://devopedia.org/css-grid-layout

grid-gap

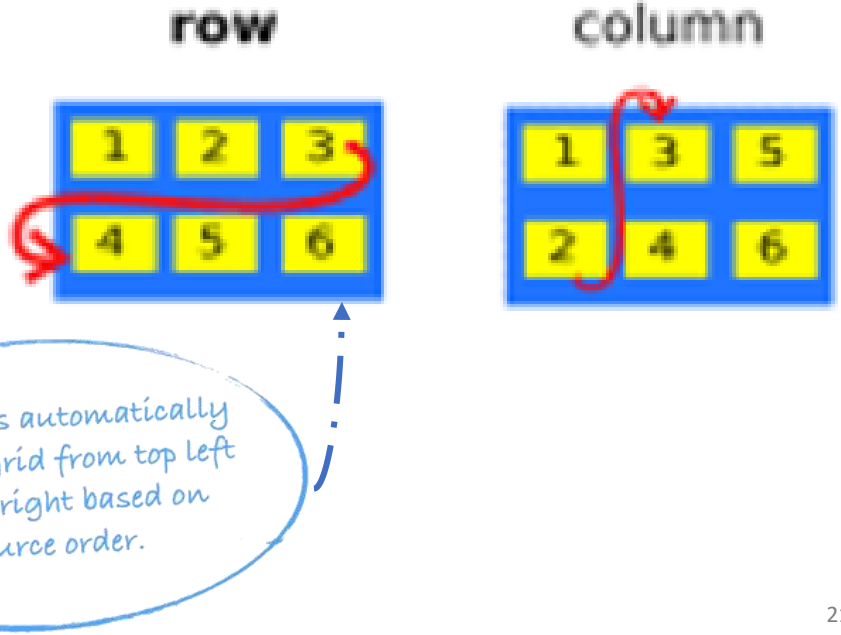
```
.page {
    display: grid;
    grid-gap: .5rem;
}
```

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



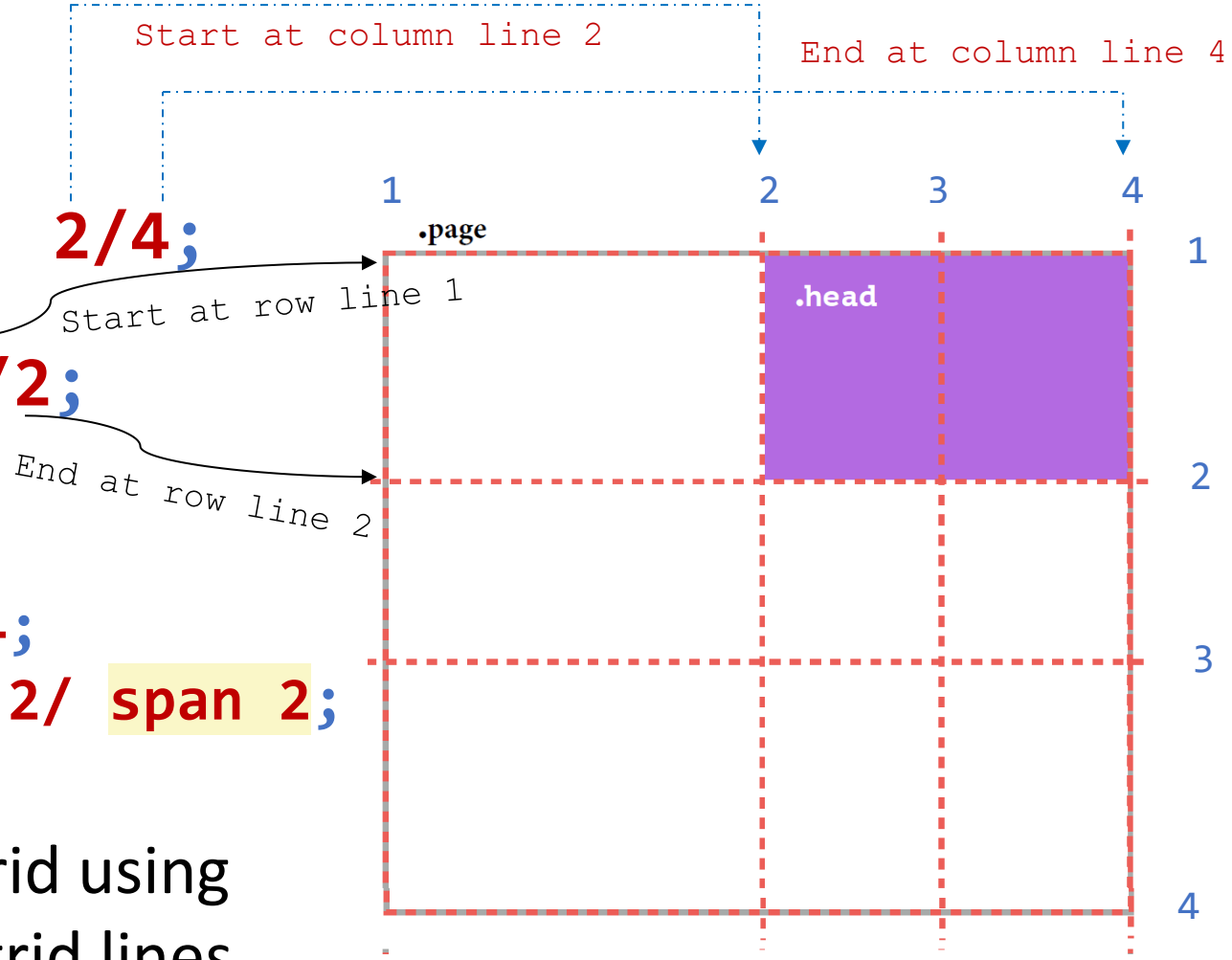
grid-auto-flow

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



Placing Items using Grid Lines

```
.head {
  grid-column: 2/4;
  grid-row: 1/2;
}
```




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

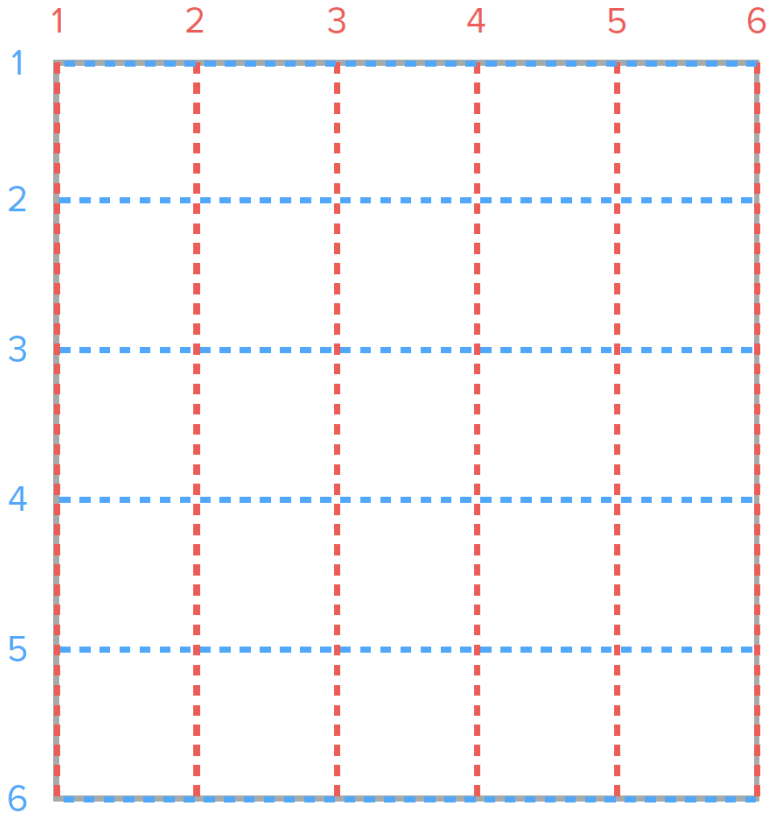
Place item in the grid using the **start** and **end** grid lines for columns and rows

```
grid-column: 1 / -1
=> spans all available columns
```

Grid **line**

- *Horizontal (**row**) or vertical (**column**) line separating the grid into sections*

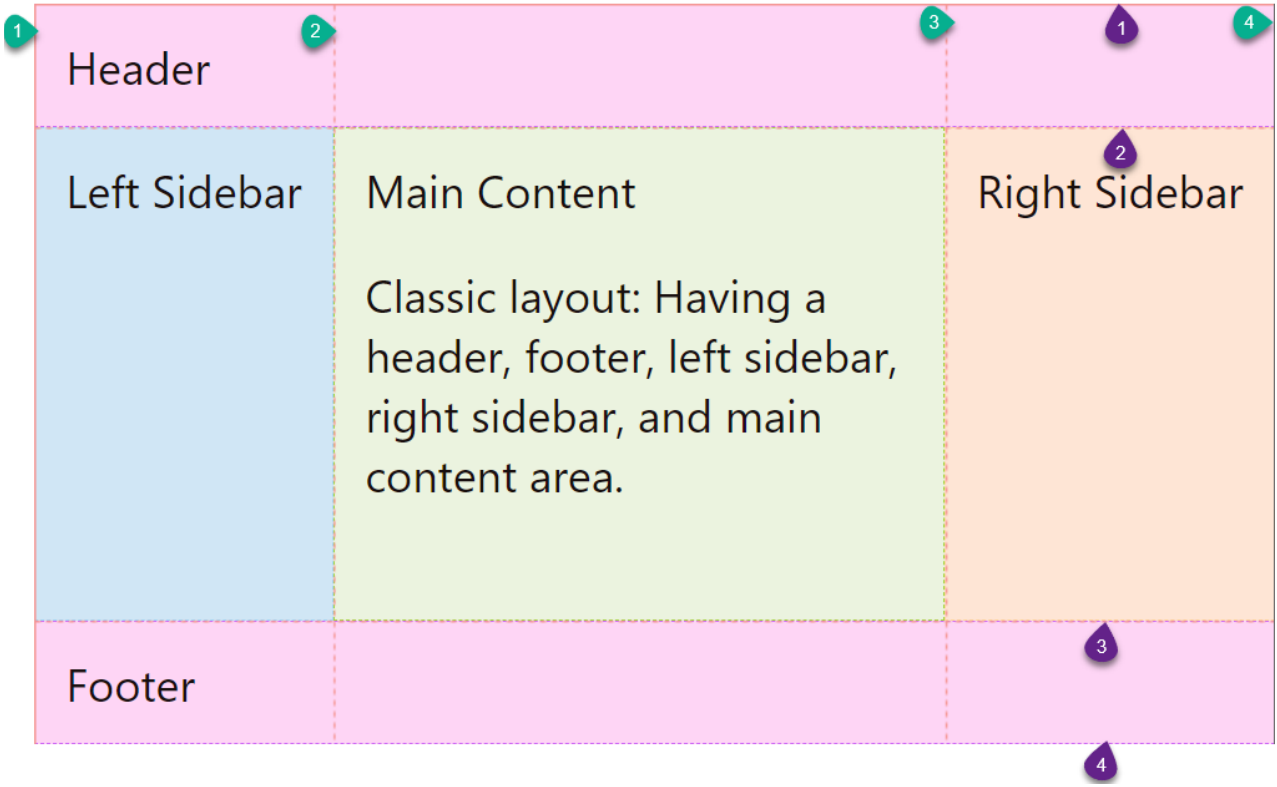
- *Grid lines are referenced by numbers, starting and ending with the outer borders of the grid*



Example - Placing Items using Grid Lines

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

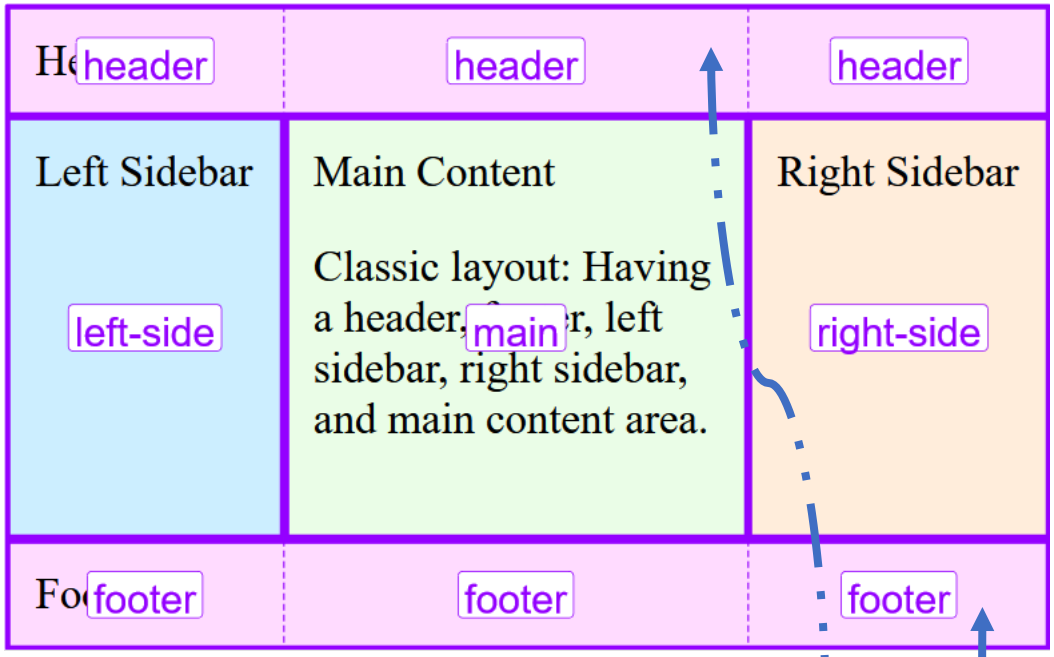
```css
header {
    grid-column: 1 / span 3;
}

.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

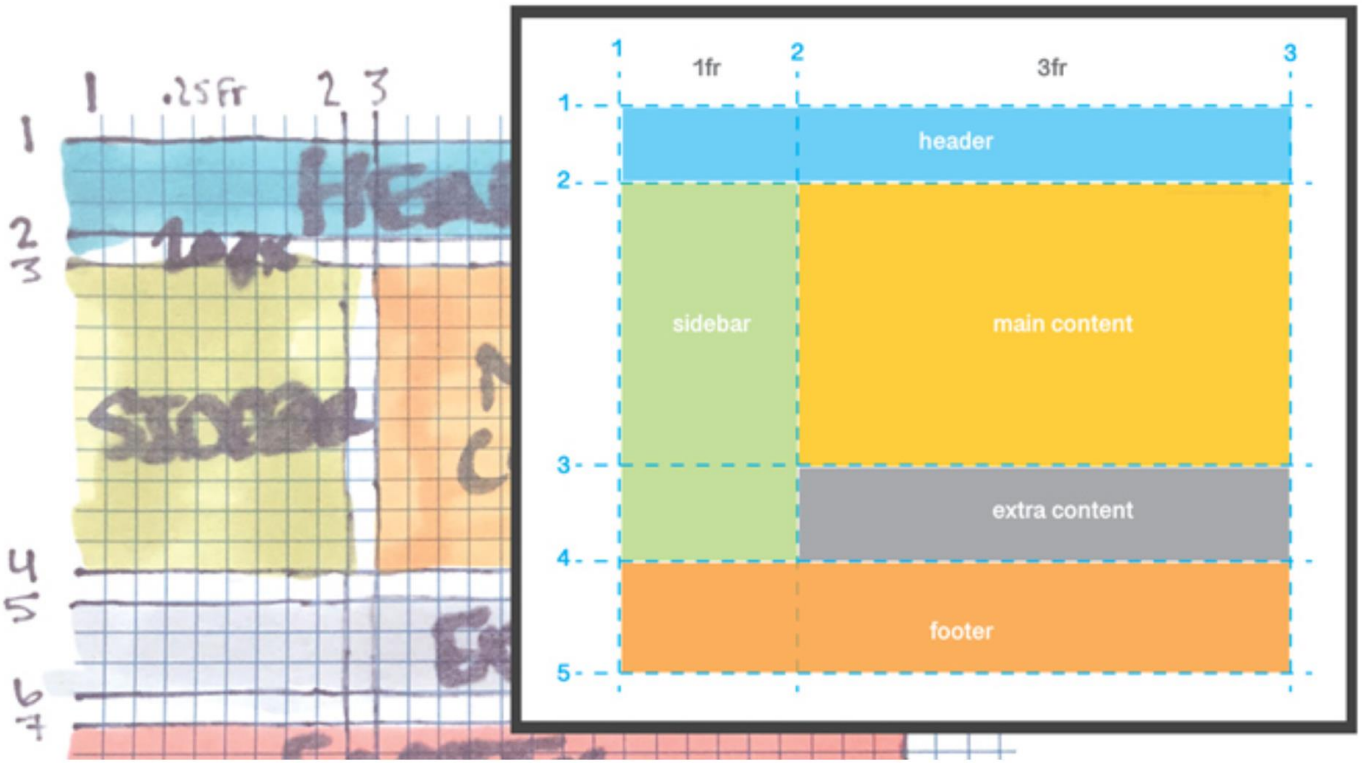



```
.container {
    display: grid;
    grid-template: auto 1fr auto
        / auto 1fr auto;
    grid-template-areas:
        "header header header"
        "left-side main right-side"
        "footer footer footer";
}
```

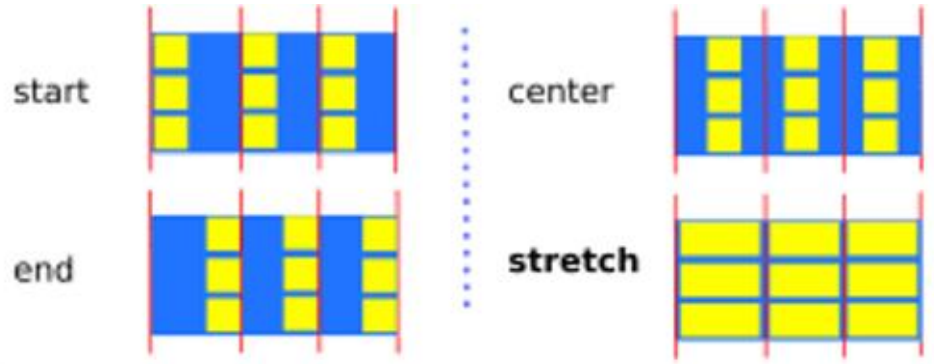
```
header {
    grid-area: header;
}
.left-side {
    grid-area: left-side;
}
main {
    grid-area: main;
}
.right-side {
    grid-area: right-side;
}
footer {
    grid-area: footer;
}
```

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

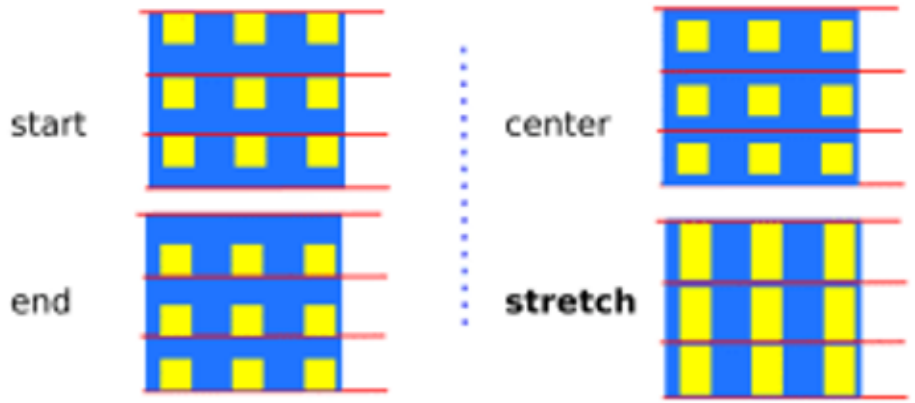


- `justify-items`
  defines alignment along the **row axis**



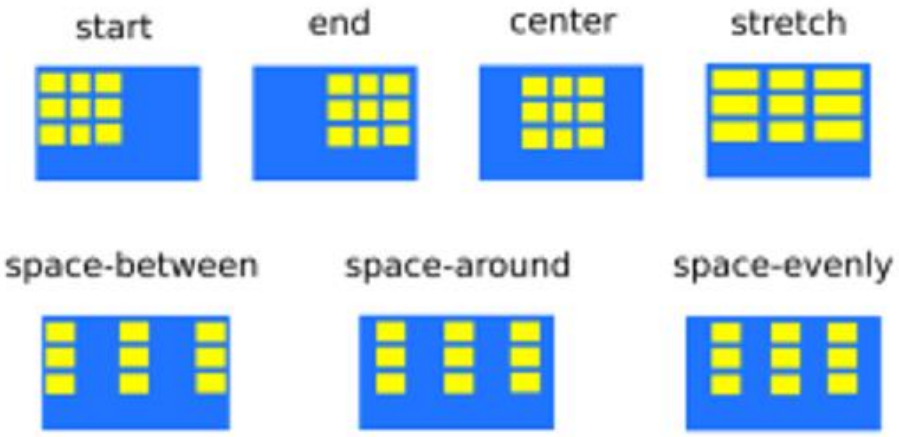
- `align-items`

defines alignment along the **column axis**



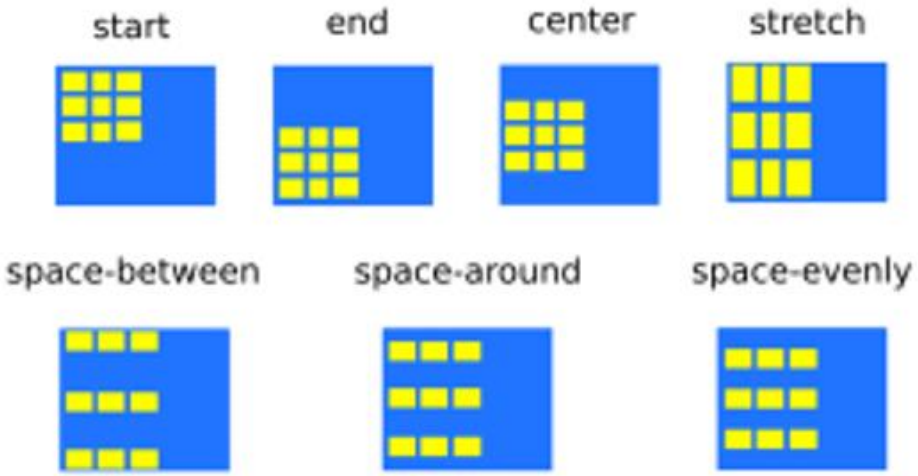
- **`justify-content`**

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



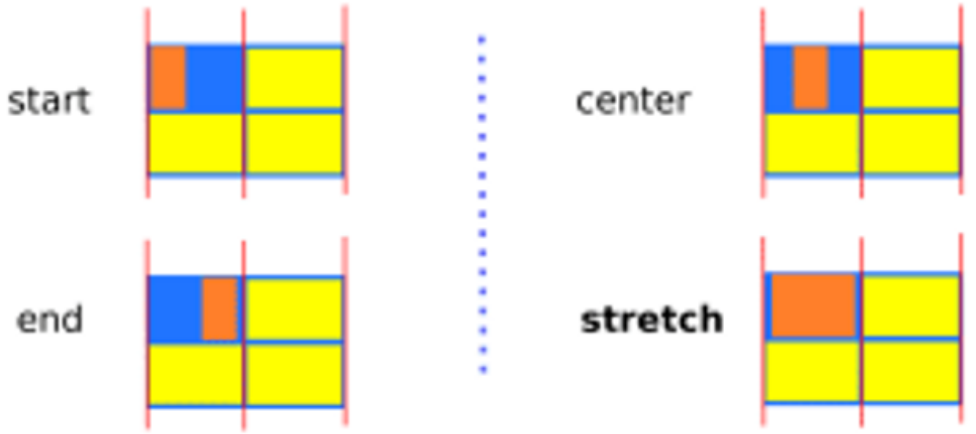
- **`align-content`**

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



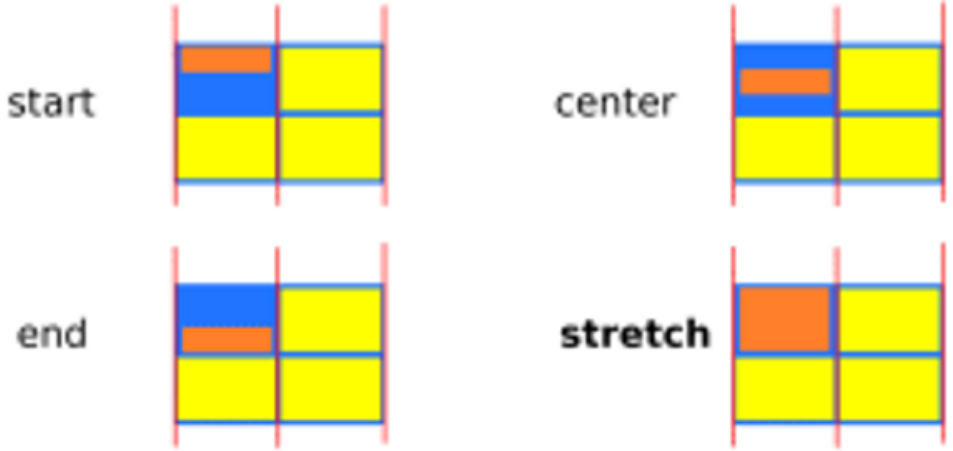
- `justify-self`

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



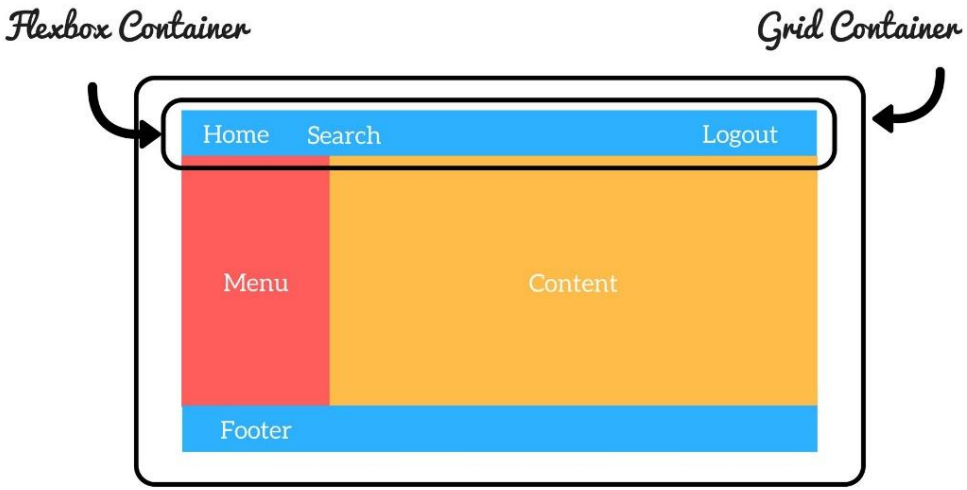
- `align-self`

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



Grid vs Flexbox

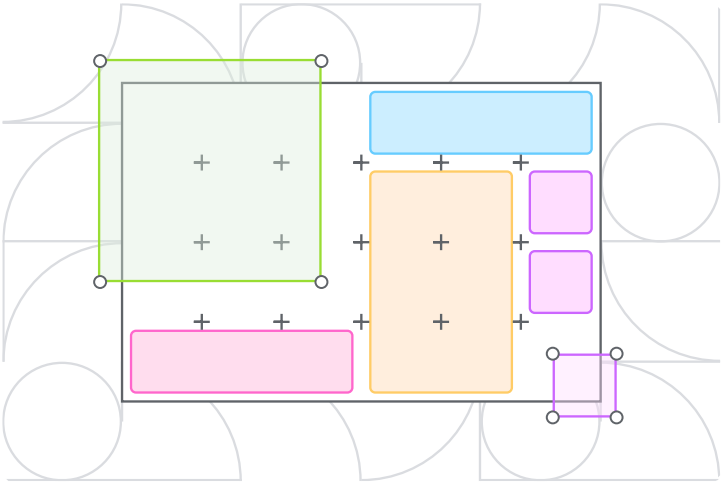
- Grid allows defining a **two-dimensional** layout with columns and rows, unlike flexbox which is a **one-dimensional layout** (either in a column or a row).
- In practice you combine these layout models. Often you can use a Flexbox container inside a Grid container
  - Grid is often used for the overall 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)



Common Layout Patterns

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

Watch explanation in this video



Back

Menu using a flexbox

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

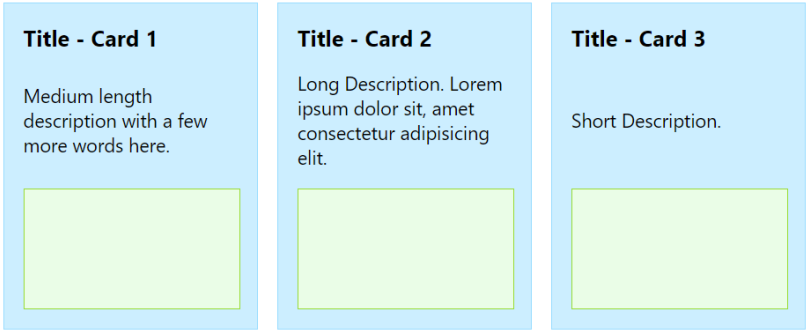

```
<nav>
    <ul>
        <li><a href="#">Home</a></li>
        <li><a href="#">About</a></li>
        <li><a href="#">Contact us</a></li>
    </ul>
</nav>
```

```
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;
}
```

Clamping card

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

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

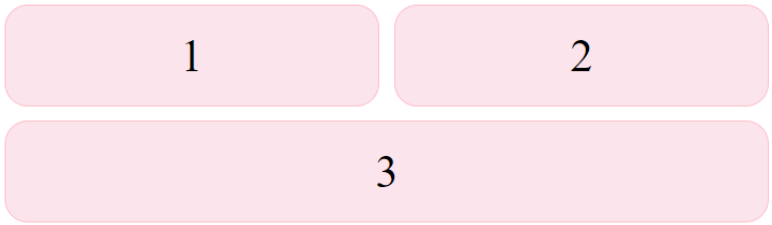
```
.card {
    width: clamp(23ch, 40%, 46ch);
}
```

- 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`

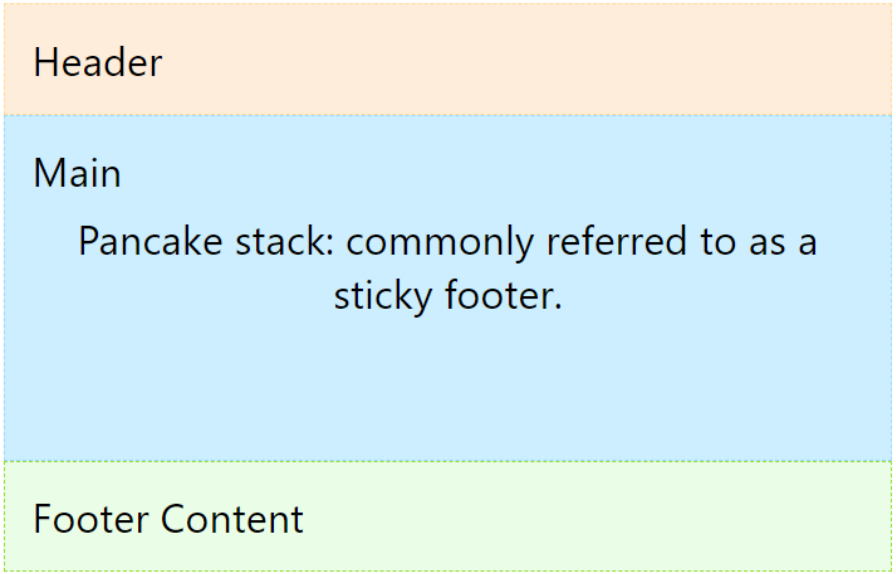
- Commonly referred to as a sticky footer

```
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)

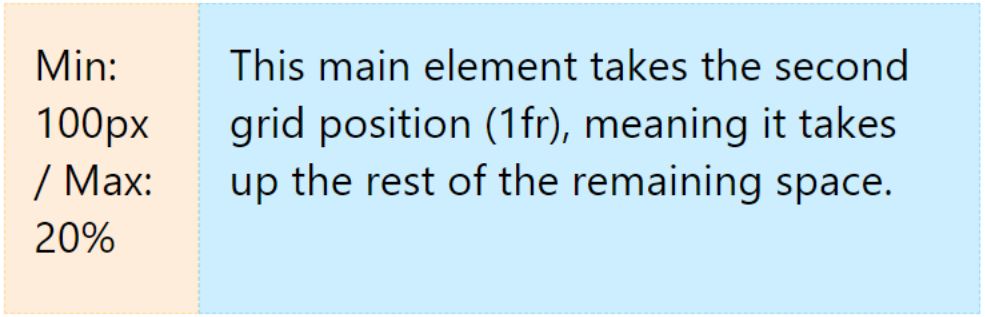


Sidebar & Content

`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;
```



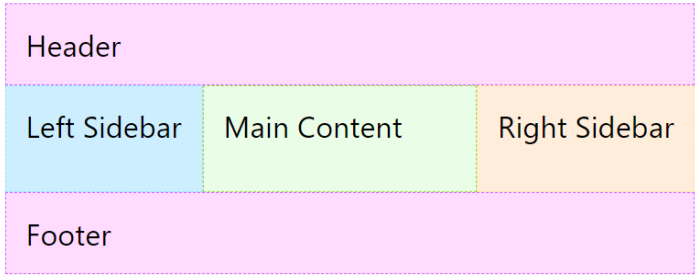
- **minmax()** function is used to set the minimum sidebar size to 100px, but letting it stretch out to 20% on larger screens
  - the main content takes up the rest of the space (1fr)

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 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-fit, 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));
```

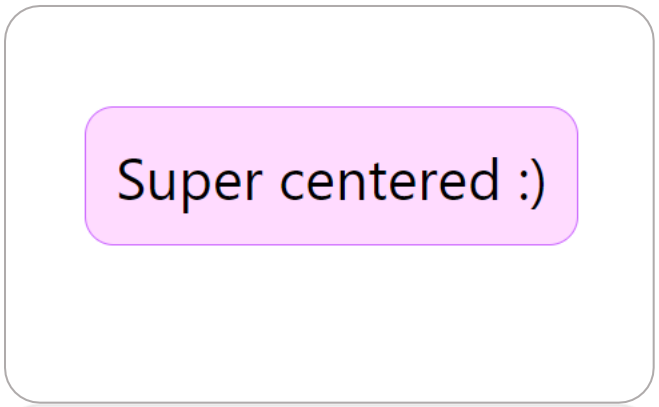
Browser!

- 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

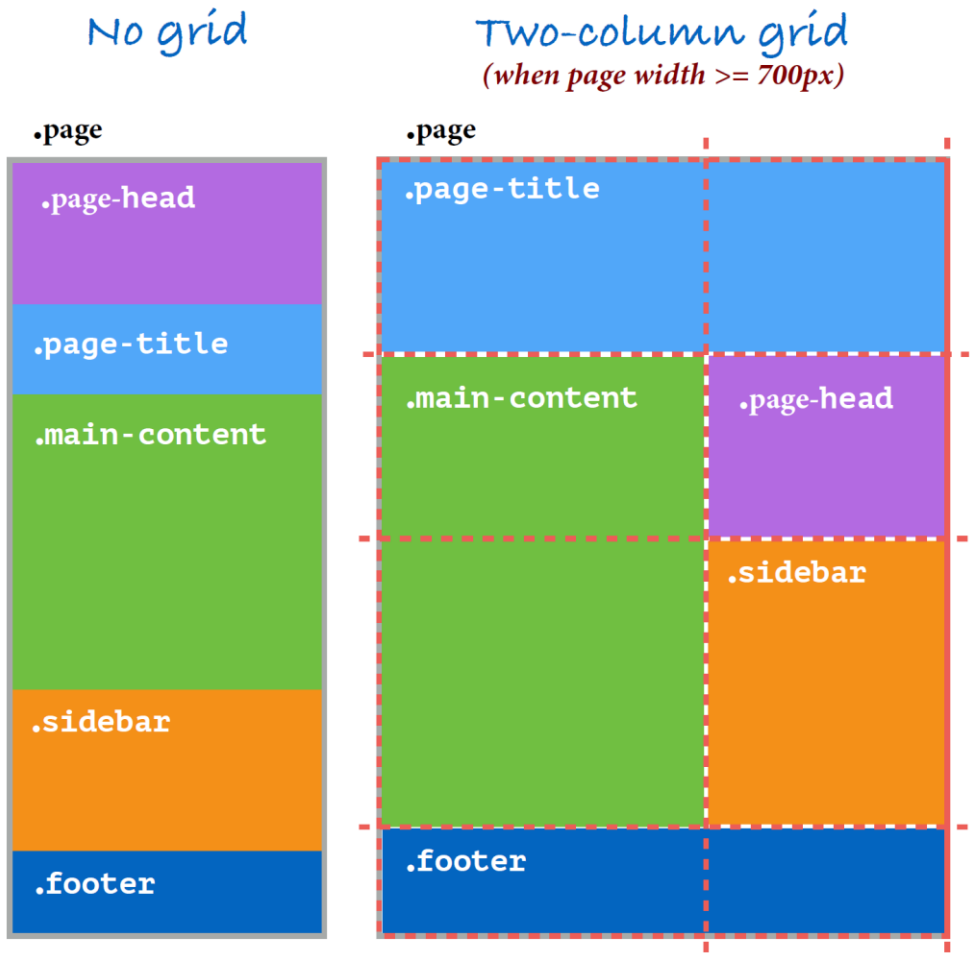


Media Queries

Responsive page layout using Media Queries

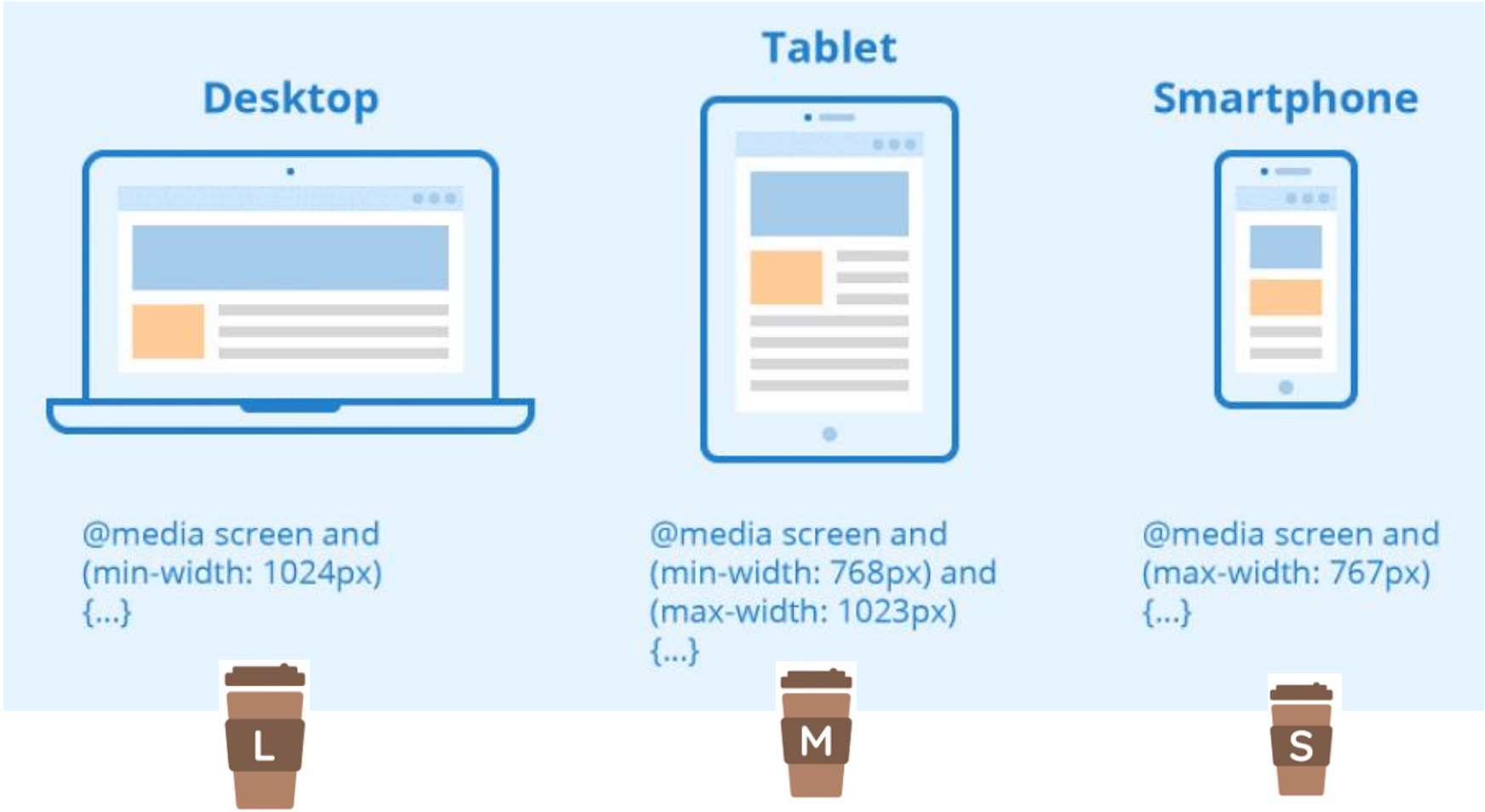
Use media queries to define layouts for different screen sizes

```
@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

Common breakpoints



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

Summary

- Use CSS Grid for ***two-dimensional*** layouts to divide a page into sections with varying sizes and positions
- Use Flexbox for ***one-dimensional*** layouts, optimizing space distribution and allowing items to adjust their width/height dynamically to best fill the available space
- Combine Grid and Media Queries for responsive design when necessary
- .. 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/