Document Object Model (DOM)

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Browser JavaScript interface to HTML document

- HTML document exposed as a collection of JavaScript objects and methods

  The **D**ocument **O**bject **M**odel (DOM)

- JavaScript can query or modify the HTML document
- Accessible via the JavaScript global scope, aliases:

  `window`

  `this` (When not using `'use strict';`)

DOM hierarchy

- Rooted at `window.document (html tag)`
- Follows HTML document structure

```
window.document.head

window.document.body
```

- Tree nodes (DOM objects) have tons (~250) of properties, most private

Objects (representing elements, raw text, etc.) have a common set of properties and methods called a DOM "Node"

DOM Node properties and methods

- Identification

  `nodeName` property is element type (uppercase: `P`, `DIV`, etc.) or `#text`

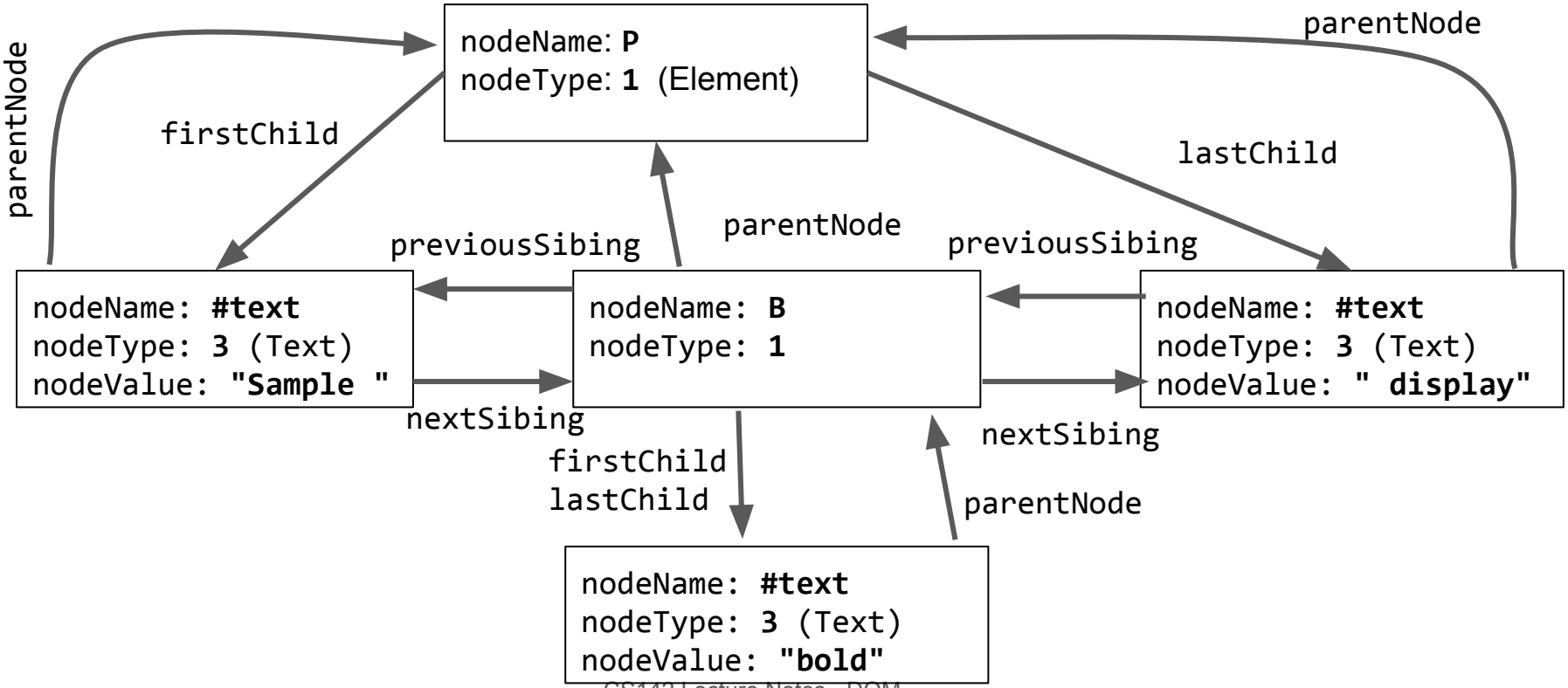
- Encode document's hierarchical structure

  `parentNode`, `nextSibling`, `previousSibling`, `firstChild`, `lastChild`.

- Provide accessor and mutator methods

  E.g. `getAttribute`, `setAttribute` methods, etc..

Sample bold display



Accessing DOM Nodes

- Walk DOM hierarchy (not recommended)

```
element = document.body.firstChild.nextSibling.firstChild;
element.setAttribute(...
```

- Use DOM lookup method. An example using ids:

HTML: `<div id="div42">...</div>`

```
element = document.getElementById("div42");
element.setAttribute(...
```

- Many: `getElementsByClassName()`, `getElementsByTagName()`, ...
  - Can start lookup at any element:
    `document.body.firstChild.getElementsByTagName()`

More commonly used Node properties/methods

- `textContent` - text content of a node and its descendants

  Previous slide example: P Node `textContext` is "Sample bold display"
- `innerHTML` - HTML syntax describing the element's descendants.

  Previous slide example: P Node `innerHTML` is "Sample bold display"
- `outerHTML` - similar but includes element " Sample bold display "
- `getAttribute()/setAttribute()` - Get or set the attribute of an element

Common DOM mutating operations

- Change the content of an element

  ```
  element.innerHTML = "This text is <i>important</i>";
  ```

  Replaces content but retains attributes. DOM Node structure updated.

- Change an `<img` tag `src` attribute (e.g. toggle appearance on click)

  ```
  img.src="newImage.jpg";
  ```

- Make element visible or invisible (e.g., for expandable sections, modals)

  Invisible: `element.style.display = "none";`
  Visible: `element.style.display = "";`

DOM and CSS interactions

- Can update an element's class

  ```
  element.className = "active";
  ```

- Can update element's style

  ```
  element.style.color = "#ff0000";    // Not preferred way!
  ```

- Can also query DOM by CSS selector

  `document.querySelector()` and `document.querySelectorAll()`

Changing the Node structure

- Create a new element (can also `cloneNode()` an existing one)

```
element = document.createElement("P");
            or
element = document.createTextNode("My Text");
```

- Add it to an existing one

```
parent.appendChild(element);
     or
parent.insertBefore(element, sibling);
```

- Can also remove Nodes: `node.removeChild(oldNode);`

- But, setting innerHTML can be simpler and more efficient.

More DOM operations

- Redirect to a new page

  ```
  window.location.href = "newPage.html";
  ```

  Note: Can result in JavaScript script execution termination

- Communicating with the user

  ```
  console.log("Reached point A");    // Message to browser log

  alert("Wow!");  confirm("OK?");    //  Popup dialog
  ```

DOM's Coordinate System

- The screen origin is at the upper left; y increases as you go down
- The position of an element is determined by the upper-left outside corner of its margin
- Read location with `element.offsetLeft`, `element.offsetTop`
- Coordinates are relative to `element.offsetParent`, which is not necessarily the same as `element.parentNode`

DOM Coordinates

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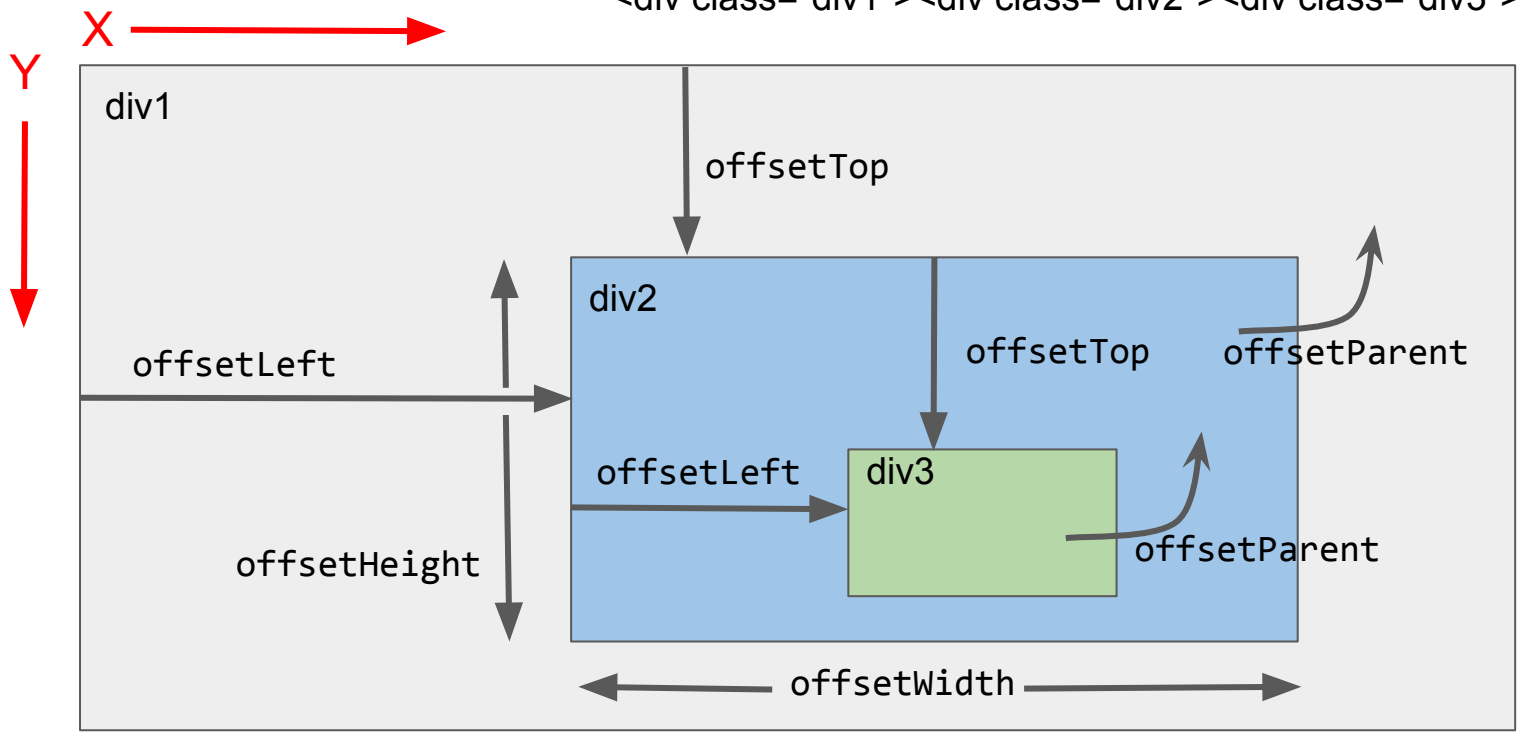


Positioning elements

- Normally elements are positioned automatically by the browser as part of the document
- To pull an element out of the document flow and position it explicitly:

```
element.style.position = "absolute";  // anything but "static"
element.style.left = "40px";
element.style.top = "10px";
```

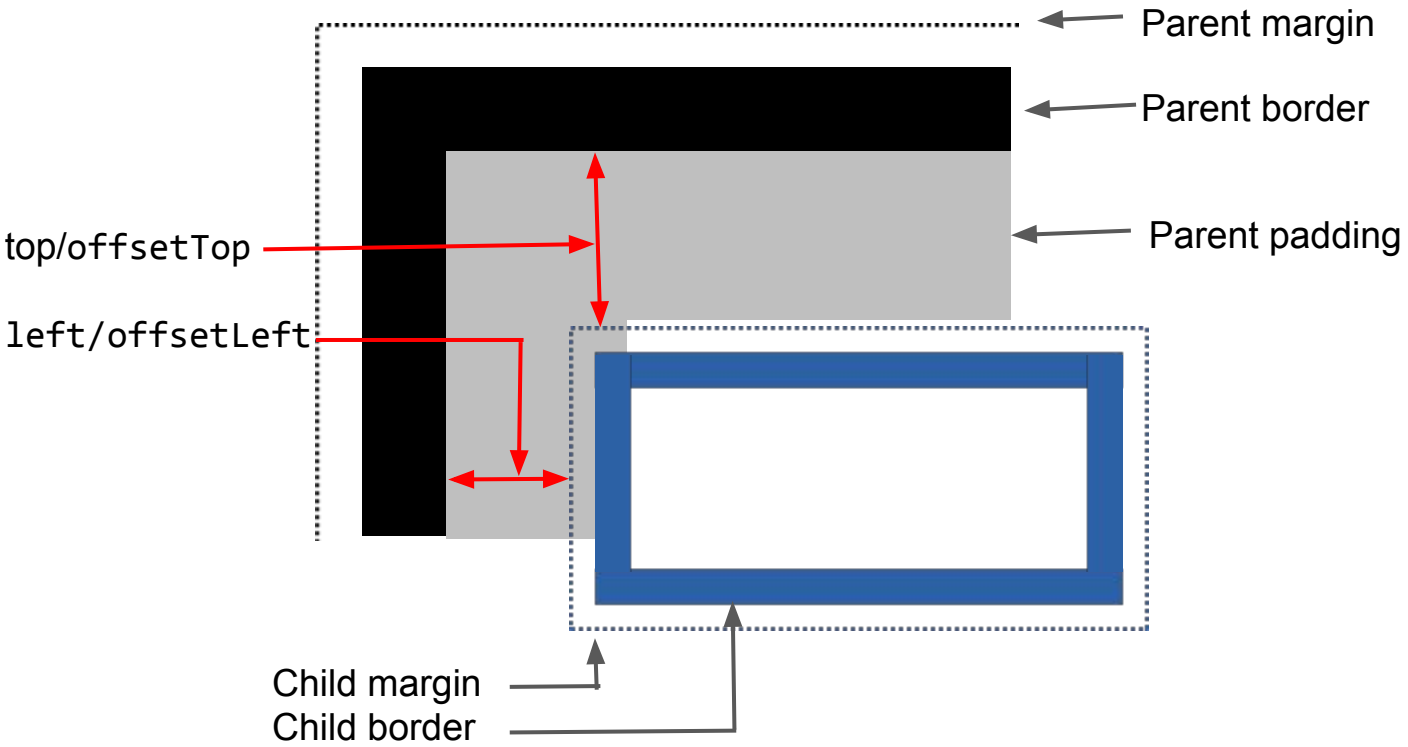
  "absolute" - the element no longer occupies space in the document flow.

- The origin inside an offsetParent (for positioning descendants) is just inside the upper-left corner of its border.

Positioning context

- Each element has an `offsetParent` (some ancestor element).
- When an element is positioned, coordinates such as `element.style.left` are relative to its `offsetParent`.
- Default `offsetParent` is the `<body>` element.
- Some elements define a new positioning context:
  - `position` CSS attribute is `absolute` (element is explicitly positioned)
  - `position` CSS attribute is `relative` (element is positioned automatically by the browser in the usual way)
  - This element will become the `offsetParent` for all its descendents (unless overridden by another positioning context)

Positioning Children



Element dimensions

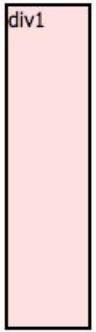
- Reading dimensions: `element.offsetWidth` and `element.offsetHeight`

  Include contents, padding, border, but not margin

- Updating dimensions: `element.style.width` and `element.style.height`

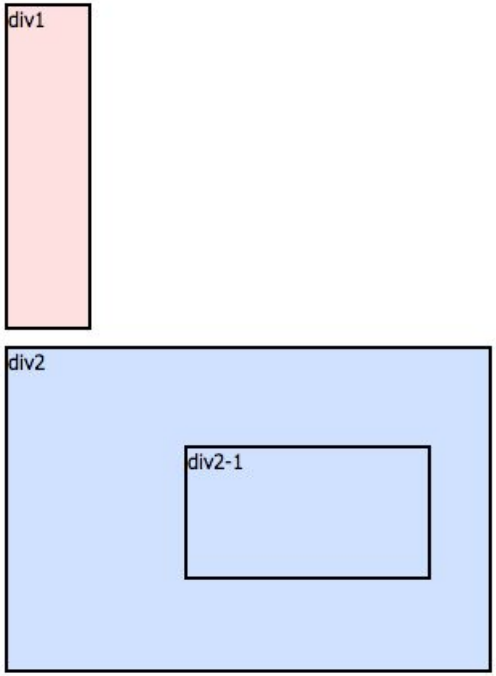
Positioning

```
<body>
    <div id="div1">
        <p>div1</p>
    </div>

#div1 {
   width: 50px;
   height: 200px;
   background: #ffe0e0;
}
```



Positioning

```
    ...
    <div id="div2">
       <p>div2</p>
       <div id="div2-1">
          <p>div2-1</p>
       </div>
    </div>
#div2 {width: 300px; height:
200px; position: relative;
    background: #d0e0ff;}

#div2-1 {width: 150px; height:
80px; position: absolute;
   top: 50px; left: 100px;
background: #d0e0ff;}
```



Positioning

```
...
    <div id="div3">
       <p>div3</p>
       <div id="div3-1">
         <p>div3-1</p>
       </div>
    </div>
#div3 {width: 300px; height:
200px; background: #ffffe0;}

#div3-1 {width: 150px; height:
80px; position: absolute; top:
50px; left: 100px; background:
#ffffe0;}
```