ICT in SES

DOM

Lesson №6

JS and the browser

BOM

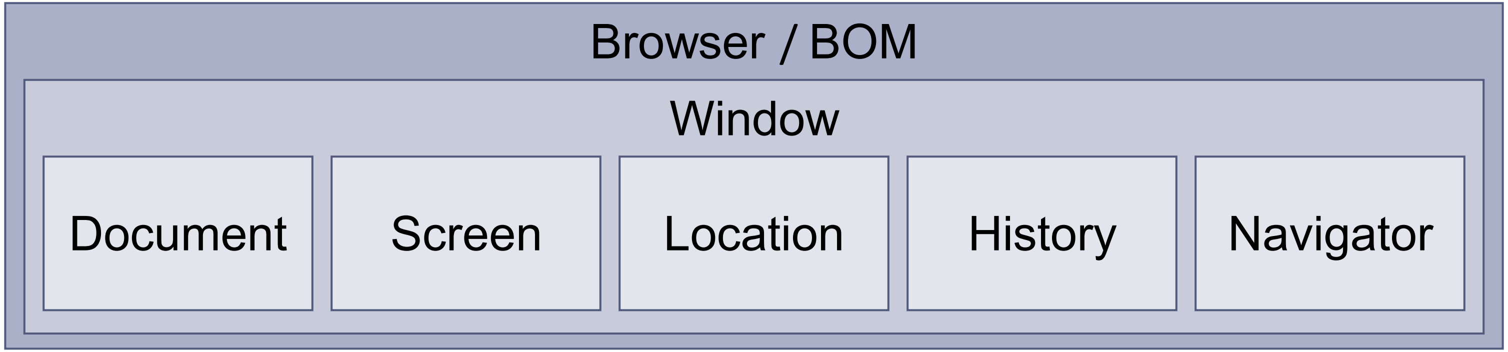
What is BOM

- Browser Object Model
- Programming interface to the browser
- Allows JS access to
  - The content of the shown web page
  - The parameters of the browser window
  - Navigation history, coockies, etc.

BOM structure

Main object window

- Page content in object document
- Window's properties in object screen
- Current URL and history in objects location and history
- Browser's settings in object navigator



Browser / BOM

Window

Document

Screen

Location

History

Navigator

More about BOM

- Formally there is no standard
- All browsers support it
- Some functions might differ

In this course

- We will mostly user object document

DOM

DOM

What is DOM

- Document Object Model
- A model for representing HTML documents as objects
- Browsers provide programming interface to DOM via their BOM object window.document

History of DOM

History

- 1995 – Legacy DOM / DOM level 0, no standard
- 1997 – Intermediate DOM, still no standard
- 1998 – DOM Level 1 – first standard
- 2000 – DOM Level 2
- 2004 – DOM Level 3
- 2014 – DOM Level 4

DOM functionality

Capabilities

- Access and modification of HTML elements
- Access and modification of CSS styles and rules
- Access and modification of events caused by the browser or the user interactions

However

- DOM only provides access
- The actual access and modification is done in JS

DOM structure

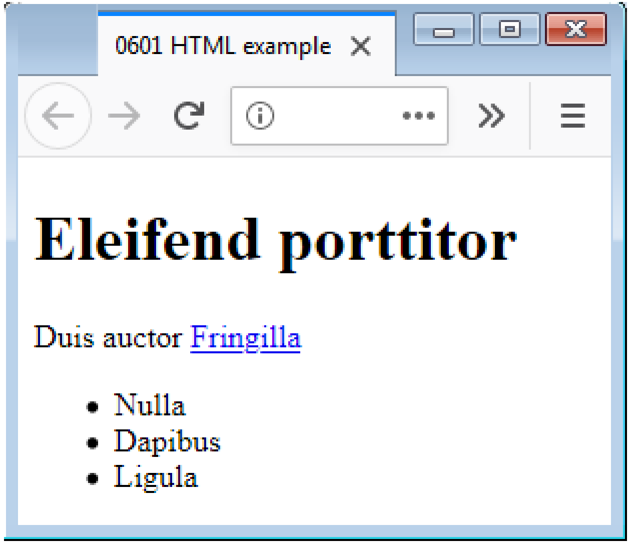
DOM as seen by JS

- Fixed hierarchy
- Objects and properties in a tree-like structure
- The root is bound to window.document
- Full access to every nod in the tree for modification, addition or removal

Relations between HTML and DOM

- Every HTML element is represented as a DOM node
- Browsers provide tools to browse the DOM structure in a page

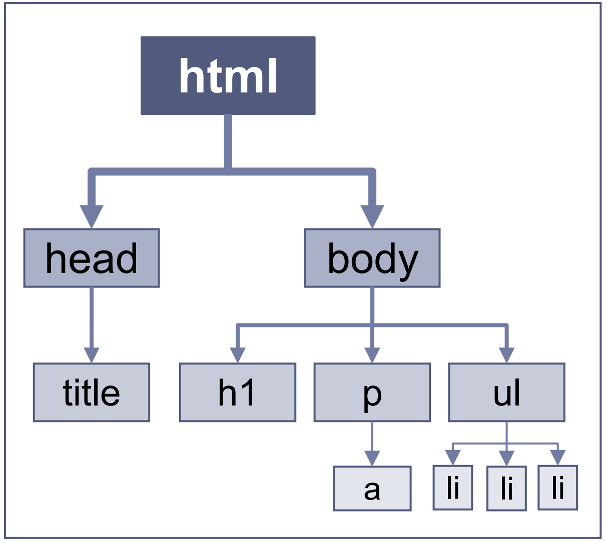
```
<html>
  <head>
    <title>Пример 0601:
           HTML пример</title>
  </head>
  <body>
    <h1>Eleifend porttitor</h1>
    <p>Duis auctor <a href="#1">
        Fringilla</a></p>
    <ul>
      <li>Nulla</li>
      <li>Dapibus</li>
      <li>Ligula</li>
    </ul>
  </body>
</html>
```

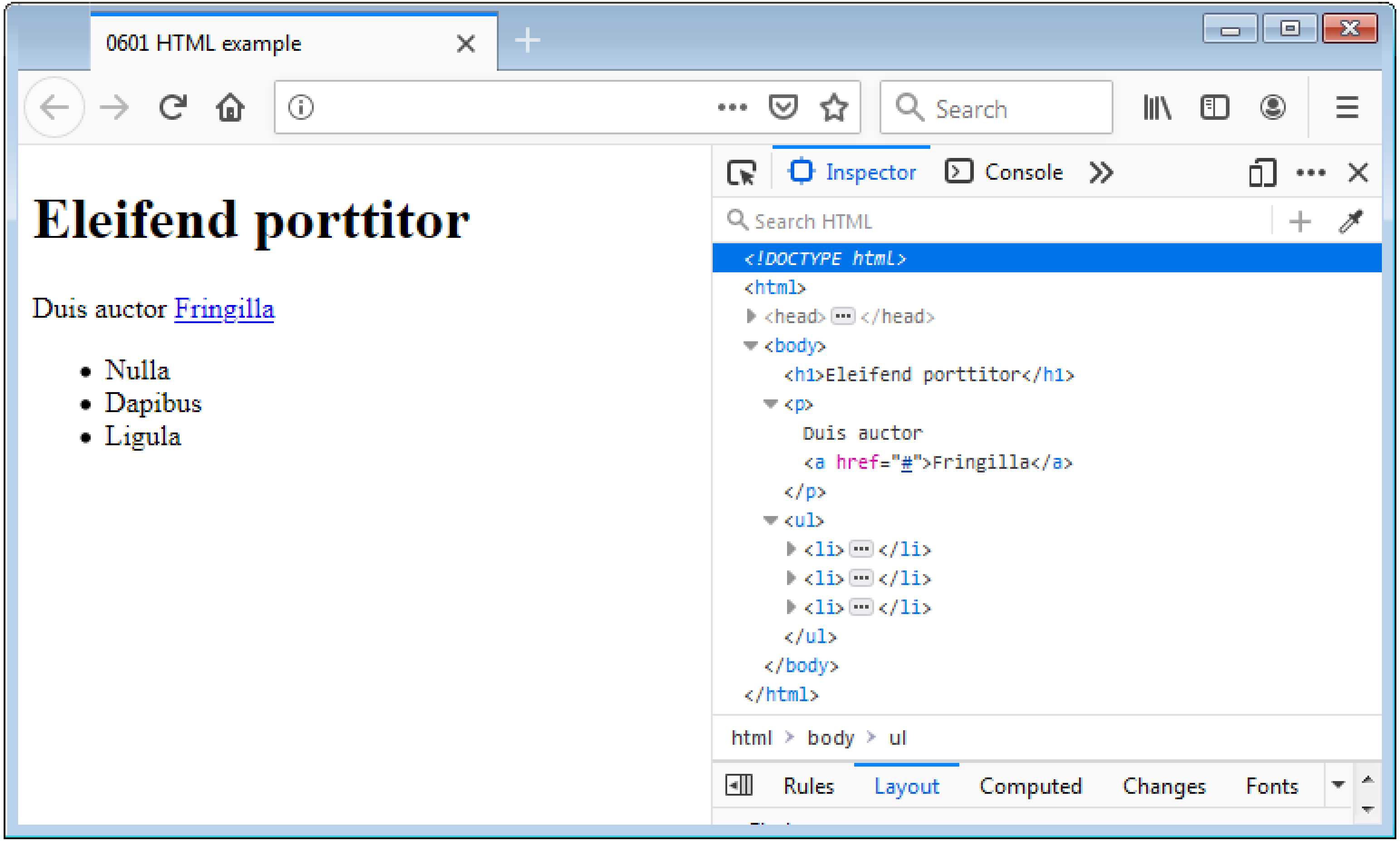


Eleifend porttitor

Duis auctor Fringilla

- Nulla
- Dapibus
- Ligula





Eleifend porttitor

Duis auctor Fringilla

- Nulla
- Dapibus
- Ligula

```
<!DOCTYPE html>
<html>
 ▶ <head> ••• </head>
 ▼ <body>
     <h1>Eleifend porttitor</h1>
   ▼ <p>
       Duis auctor
       <a href="#">Fringilla</a>
     </p>
   ▼ <ul>
     ▶ <li> ••• </li>
     ▶ <li> ••• </li>
     ▶ <li> ••• </li>
     </ul>
   </body>
</html>
```

TRY IT

Working with DOM

Working with DOM

General algorithm

- Locate needed element
- Get its properties as JS object
- Modify their values

Synchronization with page loading

- Attribute onload of element <body> – activates when the web page loading is complete (and DOM structure is generated)

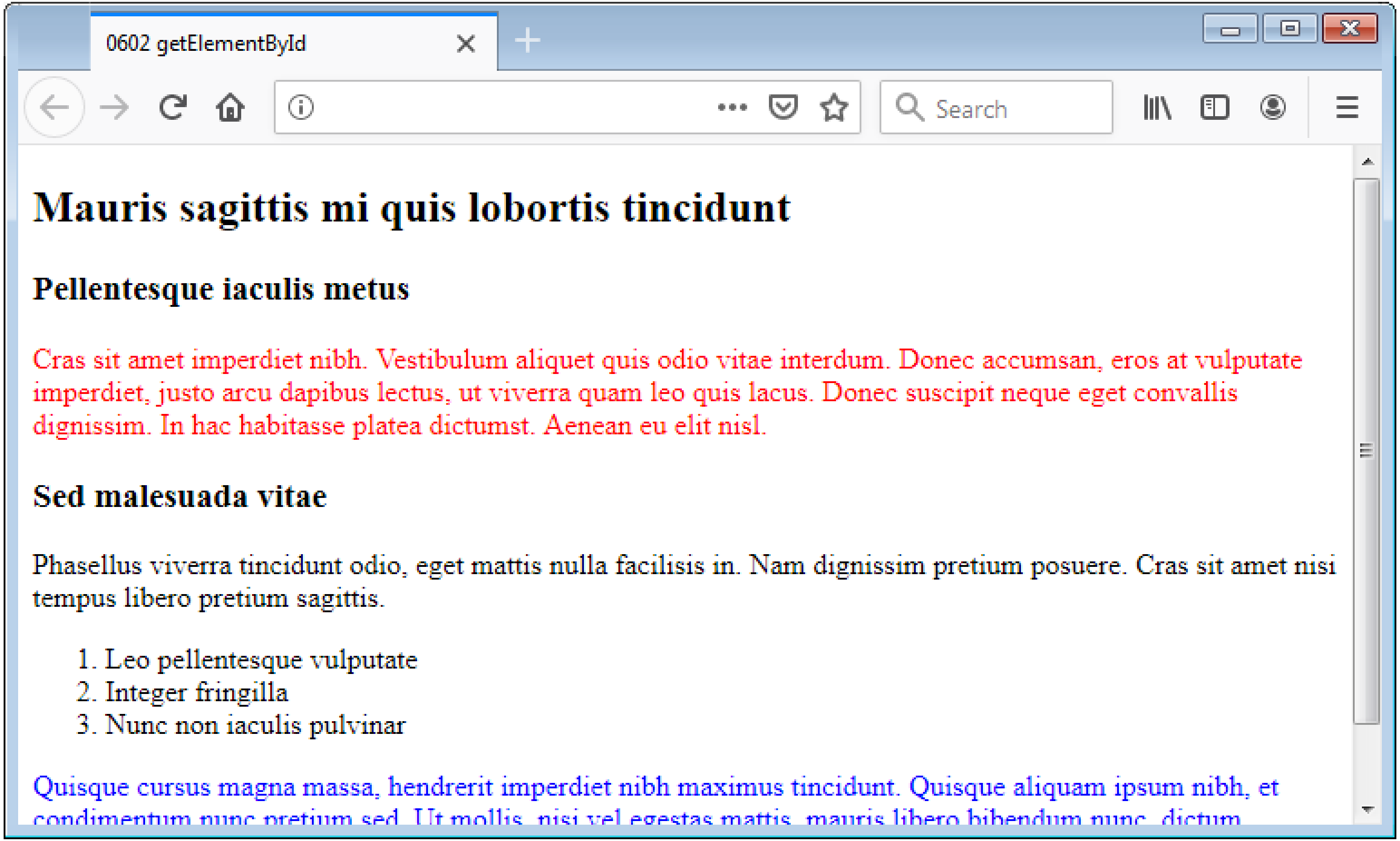
Finding element

Search via id

- Search via the attribute id with getElementById
- The result is an object with the found element or undefined
- The element style is in property style in the object

```
var e = document.getElementById('one');
e.style.color = 'red';

document.getElementById('three').style.color =
                                         '#0000FF';
```



Mauris sagittis mi quis lobortis tincidunt

Pellentesque iaculis metus

Cras sit amet imperdiet nibh. Vestibulum aliquet quis odio vitae interdum. Donec accumsan, eros at vulputate imperdiet, justo arcu dapibus lectus, ut viverra quam leo quis lacus. Donec suscipit neque eget convallis dignissim. In hac habitasse platea dictumst. Aenean eu elit nisl.

Sed malesuada vitae

Phasellus viverra tincidunt odio, eget mattis nulla facilisis in. Nam dignissim pretium posuere. Cras sit amet nisi tempus libero pretium sagittis.

1. Leo pellentesque vulputate
2. Integer fringilla
3. Nunc non iaculis pulvinar

Quisque cursus magna massa, hendrerit imperdiet nibh maximus tincidunt. Quisque aliquam ipsum nibh, et condimentum nunc pretium sed. Ut mollis, nisi vel egestas mattis, mauris libero bibendum nunc, dictum

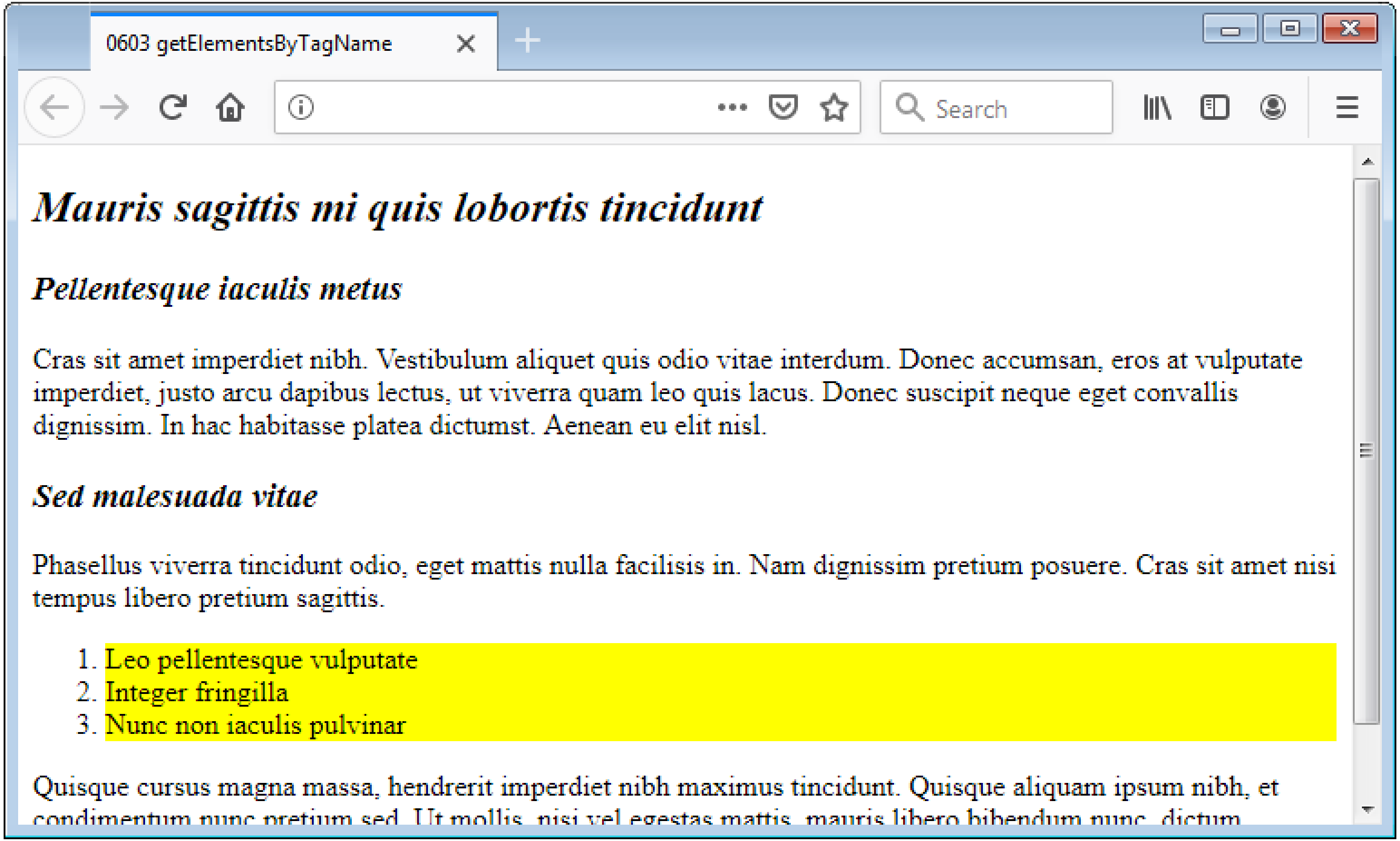
TRY IT

Methods getElements

- Search via the attribute class with getElementsByClassName
- Search for the element’s type with getElementsByTagName
- The result is an array of found elements

```
var li = document.getElementsByTagName('li');

for (var e=0; e<li.length; e++)
   li[e].style.backgroundColor = 'yellow';
```



Mauris sagittis mi quis lobortis tincidunt

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Cras sit amet imperdiet nibh. Vestibulum aliquet quis odio vitae interdum. Donec accumsan, eros at vulputate imperdiet, justo arcu dapibus lectus, ut viverra quam leo quis lacus. Donec suscipit neque eget convallis dignissim. In hac habitasse platea dictumst. Aenean eu elit nisl.

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Quisque cursus magna massa, hendrerit imperdiet nibh maximus tincidunt. Quisque aliquam ipsum nibh, et condimentum nunc pretium sed. Ut mollis, nisi vel egestas mattis, mauris libero bibendum nunc, dictum

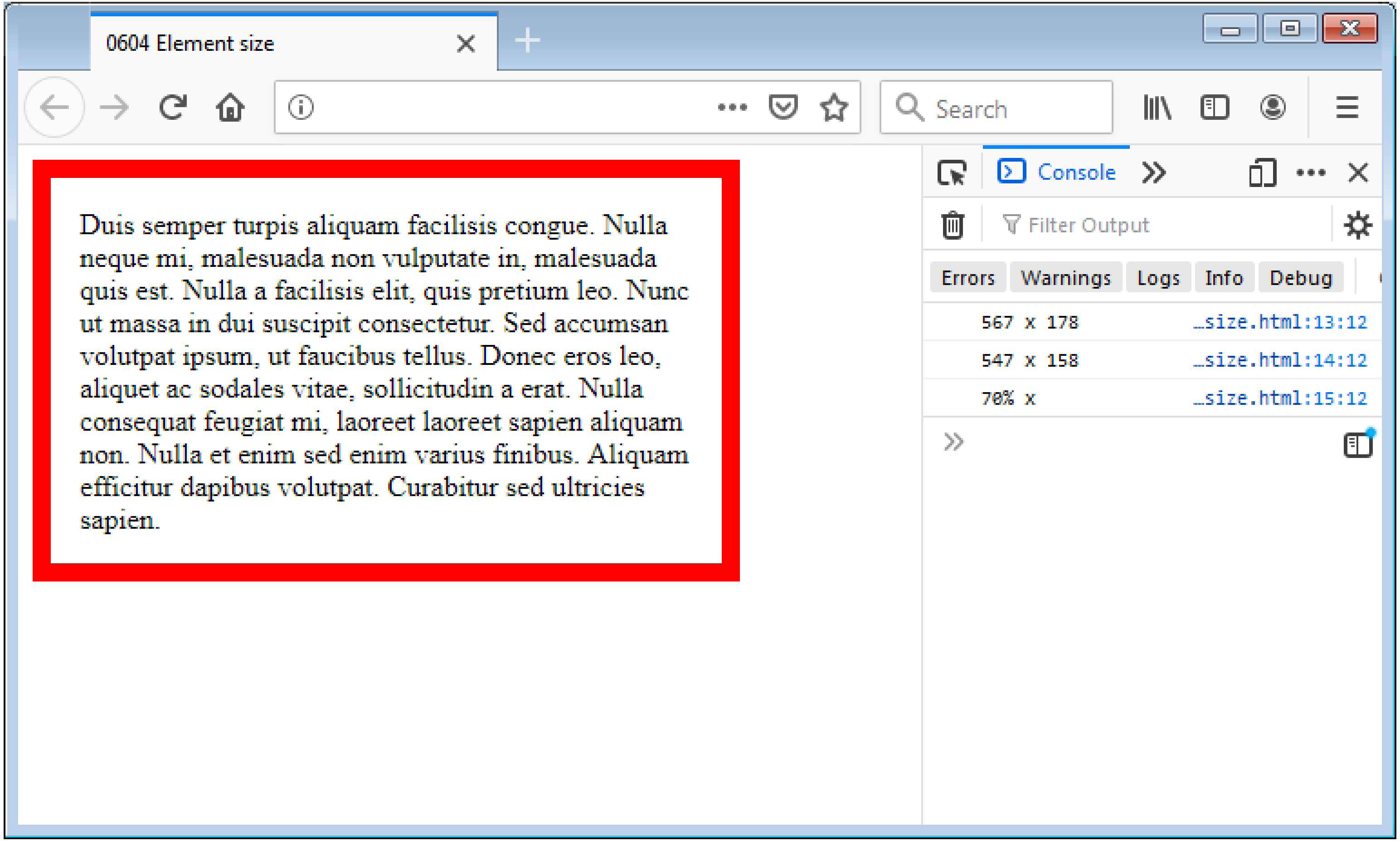
TRY IT

Sizing elements

Extracting the size

- With the border – offsetWidth and offsetHeight
- Without the border – clientWidth and clientHeight
- According to the style – style.width and style.height

```
var e = document.getElementById('box');
console.log(e.offsetWidth+' x '+e.offsetHeight);
console.log(e.clientWidth+' x '+e.clientHeight);
console.log(e.style.width+' x '+e.style.height);
```



Duis semper turpis aliquam facilisis congue. Nulla neque mi, malesuada non vulputate in, malesuada quis est. Nulla a facilisis elit, quis pretium leo. Nunc ut massa in dui suscipit consectetur. Sed accumsan volutpat ipsum, ut faucibus tellus. Donec eros leo, aliquet ac sodales vitae, sollicitudin a erat. Nulla consequat feugiat mi, laoreet laoreet sapien aliquam non. Nulla et enim sed enim varius finibus. Aliquam efficitur dapibus volutpat. Curabitur sed ultricies sapien.

```
567 x 178          …size.html:13:12
547 x 158          …size.html:14:12
70% x              …size.html:15:12
```

TRY IT

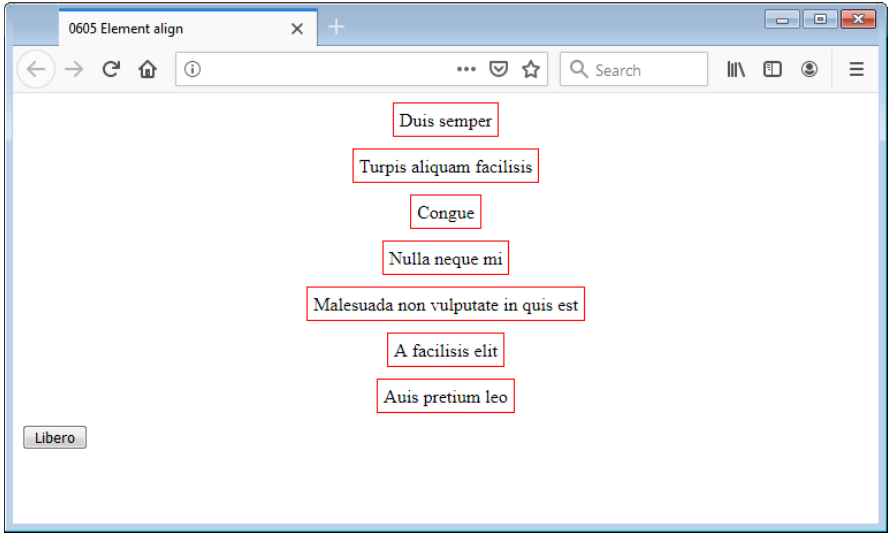
Resizing

- Several text elements with different sizes
- Aligning them to the largest size with a button click
- However clientWidth is read-only, so we modify style.width

```
var spans = document.getElementsByTagName('span');

var max = 0;
for (var i=0; i<spans.length; i++)
   max = Math.max(max,spans[i].clientWidth);

for (var i=0; i<spans.length; i++)
   spans[i].style.width = max+'px';
```



Duis semper

Turpis aliquam facilisis

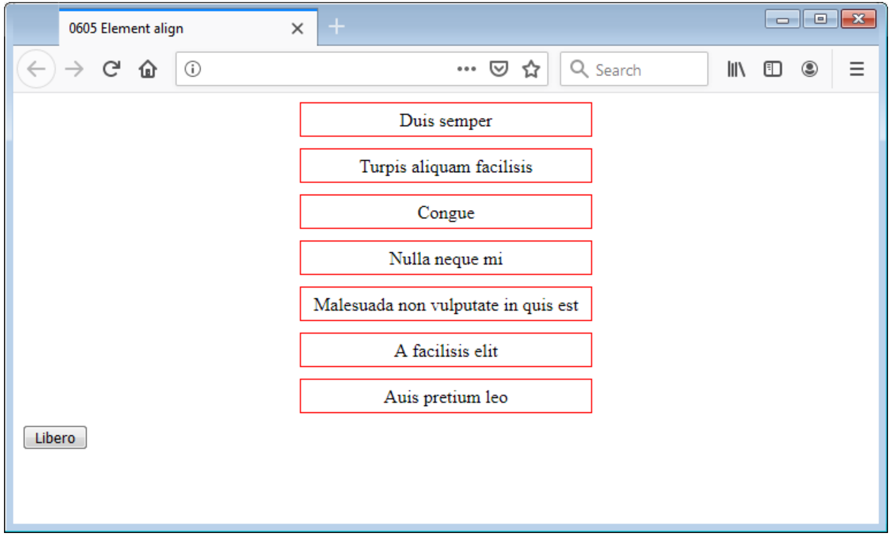
Congue

Nulla neque mi

Malesuada non vulputate in quis est

A facilisis elit

Auis pretium leo



Duis semper

Turpis aliquam facilisis

Congue

Nulla neque mi

Malesuada non vulputate in quis est

A facilisis elit

Auis pretium leo

TRY IT

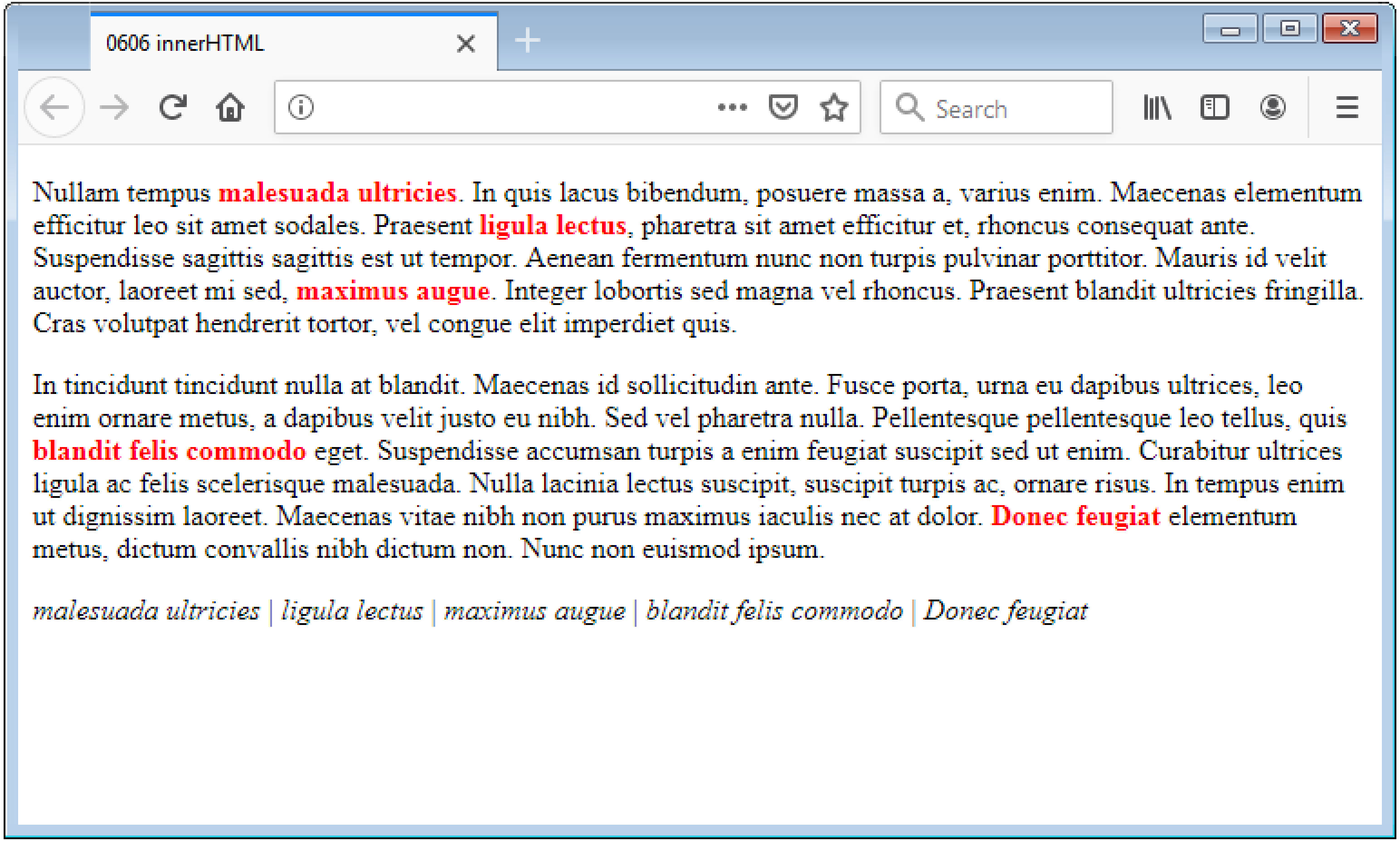
Element content

HTML content

- The full content as HTML text with innerHTML
- If there are nested elements, they are included as tags
- Example: extract the content of one element and put is as content of another element

```
var q = '';
var b = document.getElementsByTagName('b');
for (var i=0; i<b.length; i++) q += b[i].innerHTML;

document.getElementById('result').innerHTML = q;
```



Nullam tempus **malesuada ultricies**. In quis lacus bibendum, posuere massa a, varius enim. Maecenas elementum efficitur leo sit amet sodales. Praesent **ligula lectus**, pharetra sit amet efficitur et, rhoncus consequat ante. Suspendisse sagittis sagittis est ut tempor. Aenean fermentum nunc non turpis pulvinar porttitor. Mauris id velit auctor, laoreet mi sed, **maximus augue**. Integer lobortis sed magna vel rhoncus. Praesent blandit ultricies fringilla. Cras volutpat hendrerit tortor, vel congue elit imperdiet quis.

In tincidunt tincidunt nulla at blandit. Maecenas id sollicitudin ante. Fusce porta, urna eu dapibus ultrices, leo enim ornare metus, a dapibus velit justo eu nibh. Sed vel pharetra nulla. Pellentesque pellentesque leo tellus, quis **blandit felis commodo** eget. Suspendisse accumsan turpis a enim feugiat suscipit sed ut enim. Curabitur ultrices ligula ac felis scelerisque malesuada. Nulla lacinia lectus suscipit, suscipit turpis ac, ornare risus. In tempus enim ut dignissim laoreet. Maecenas vitae nibh non purus maximus iaculis nec at dolor. **Donec feugiat** elementum metus, dictum convallis nibh dictum non. Nunc non euismod ipsum.

malesuada ultricies | *ligula lectus* | *maximus augue* | *blandit felis commodo* | *Donec feugiat*

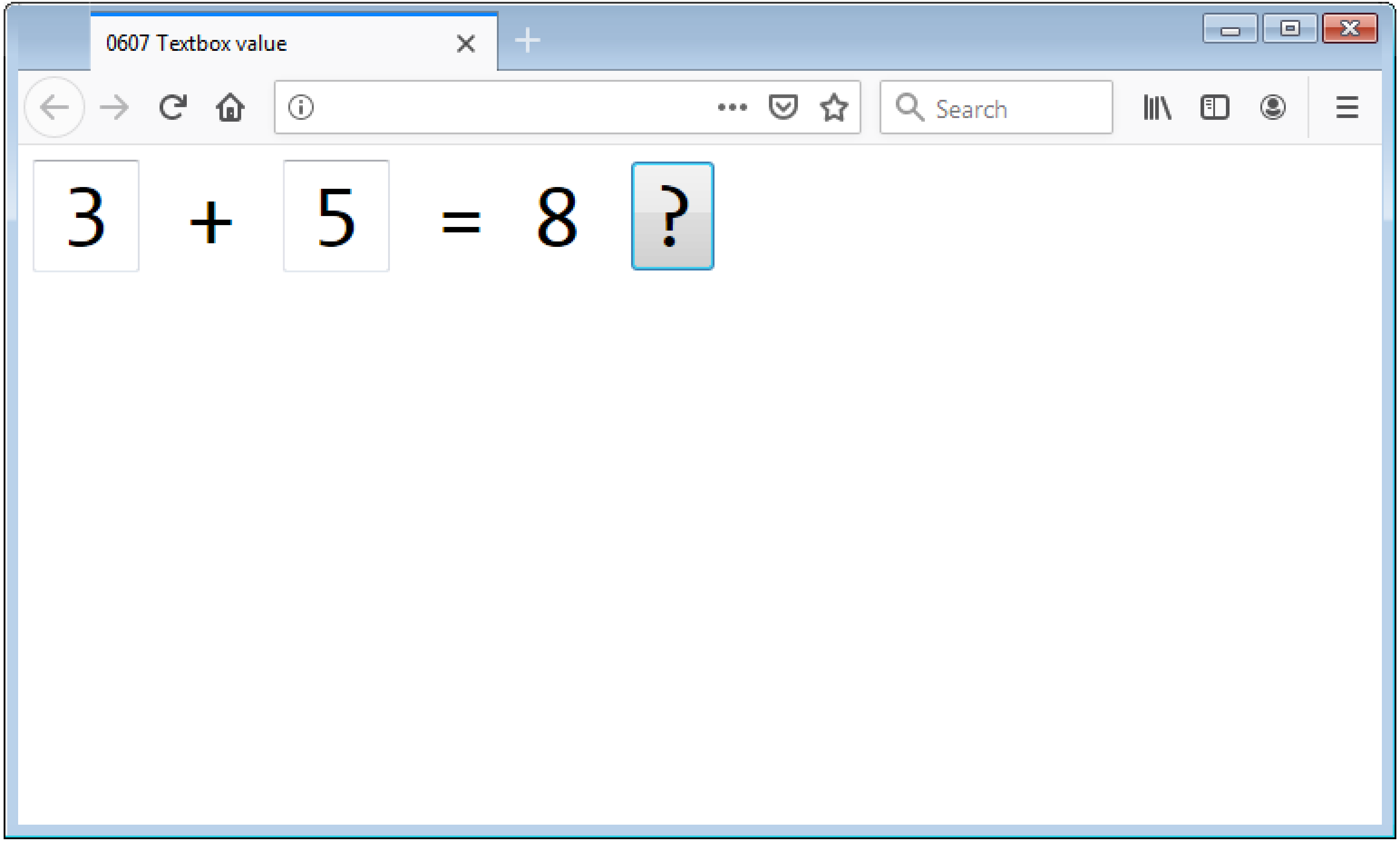
TRY IT

Content of text elements

- Shown text is in the attribute value
- If a number is needed, the tax can be converted with Number, parseInt or parseFloat

```
var n1=Number(document.getElementById('num1').value);
var n2=Number(document.getElementById('num2').value);

document.getElementById('res').innerHTML=n1+n2;
```



TRY IT

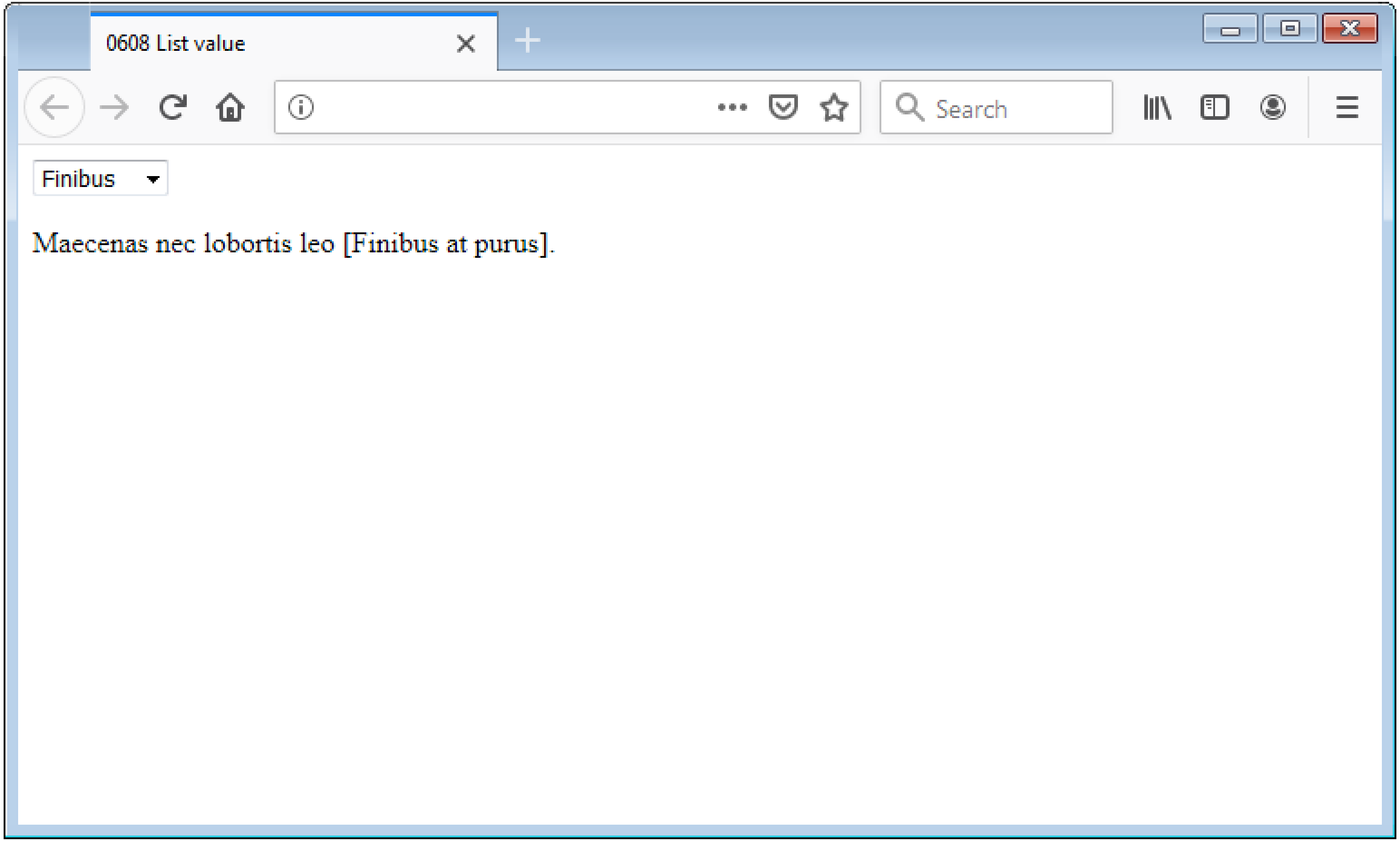
List content

- Elements are defined with tags select and option, the shown and the actual values could deffer
- Element selection activates onchange

```
<select id="list" onchange="newSelection()">
  <option value="Morbi ipsum primis">Morbi</option>
  <option value="Vel orci luctus">Vel</option>
</select>
```

- Access to the selected value is with value

```
document.getElementById('list').value;
```



Maecenas nec lobortis leo [Finibus at purus].

TRY IT

Events

Events

Examples of events

- The mouse is moved
- An HTML element is activated
- The keyboard is used
- The window is resized
- The web page is loaded

Properties of events

- Where – this is HTML, DOM or BOM element
- A JS function which will process the event
- Additional parameters of the event (depending on its type)
- Most events are applicable to many elements and are processed in an unified way
- Some elements have specific events

Frequently used events

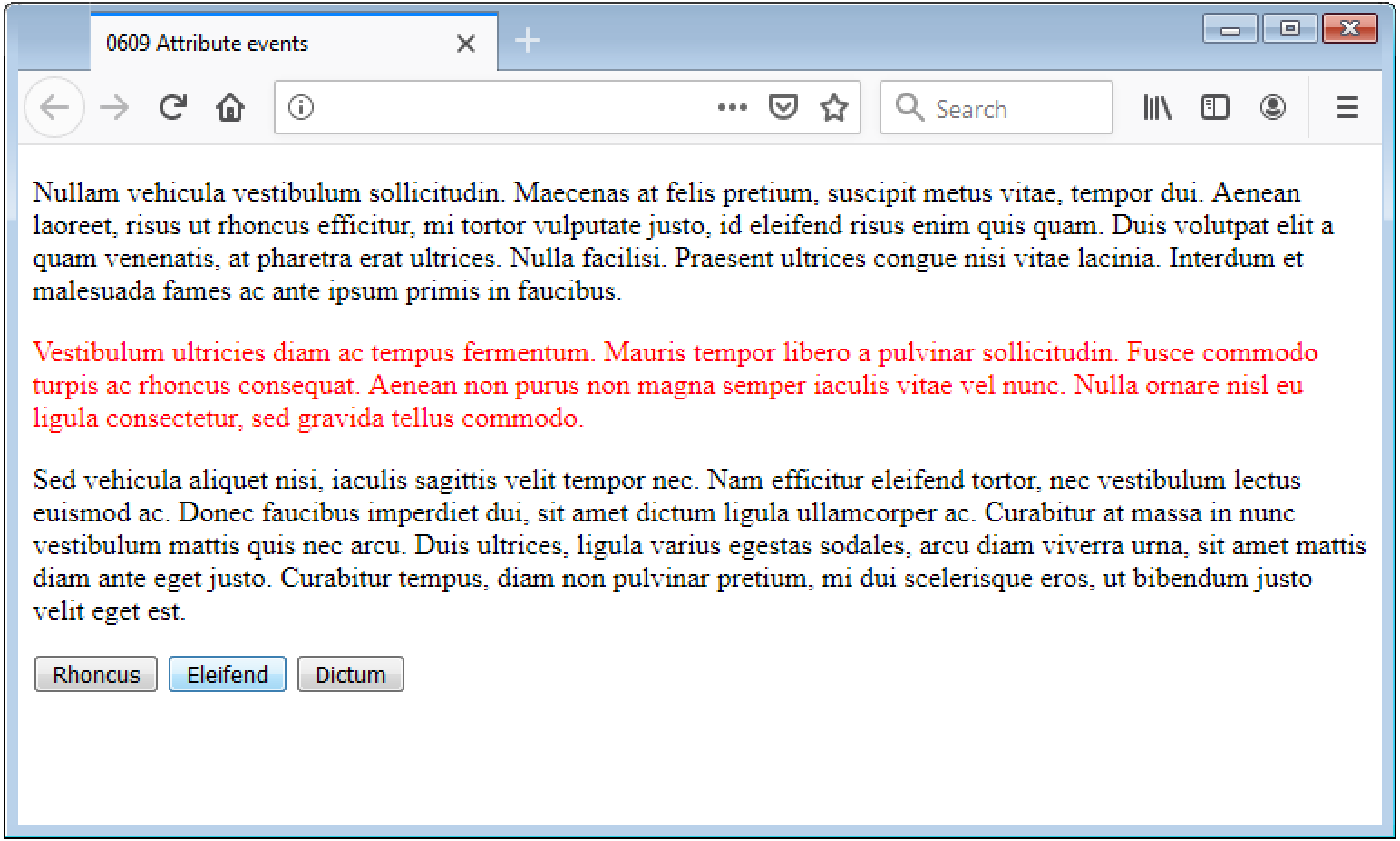
- General events
  - onload – the web page is loaded
  - onresize – the window is resized
- Events for HTML elements
  - onclick – mouse click on an element
  - onchange – element content is changed
  - onmousemove – mouse is moved over an element
  - onkeypress – a key is pressed

Capturing events

Via an attribute of an HTML element

- The name of the attribute is ‘on’ + the name of the event
- The value of the attribute is the JS code to execute

```
<button onclick="recolor(0)">Rhoncus</button>
<button onclick="recolor(1)">Eleifend</button>
<button onclick="recolor(2)">Dictum</button>
```



Nullam vehicula vestibulum sollicitudin. Maecenas at felis pretium, suscipit metus vitae, tempor dui. Aenean laoreet, risus ut rhoncus efficitur, mi tortor vulputate justo, id eleifend risus enim quis quam. Duis volutpat elit a quam venenatis, at pharetra erat ultrices. Nulla facilisi. Praesent ultrices congue nisi vitae lacinia. Interdum et malesuada fames ac ante ipsum primis in faucibus.

Vestibulum ultricies diam ac tempus fermentum. Mauris tempor libero a pulvinar sollicitudin. Fusce commodo turpis ac rhoncus consequat. Aenean non purus non magna semper iaculis vitae vel nunc. Nulla ornare nisl eu ligula consectetur, sed gravida tellus commodo.

Sed vehicula aliquet nisi, iaculis sagittis velit tempor nec. Nam efficitur eleifend tortor, nec vestibulum lectus euismod ac. Donec faucibus imperdiet dui, sit amet dictum ligula ullamcorper ac. Curabitur at massa in nunc vestibulum mattis quis nec arcu. Duis ultrices, ligula varius egestas sodales, arcu diam viverra urna, sit amet mattis diam ante eget justo. Curabitur tempus, diam non pulvinar pretium, mi dui scelerisque eros, ut bibendum justo velit eget est.

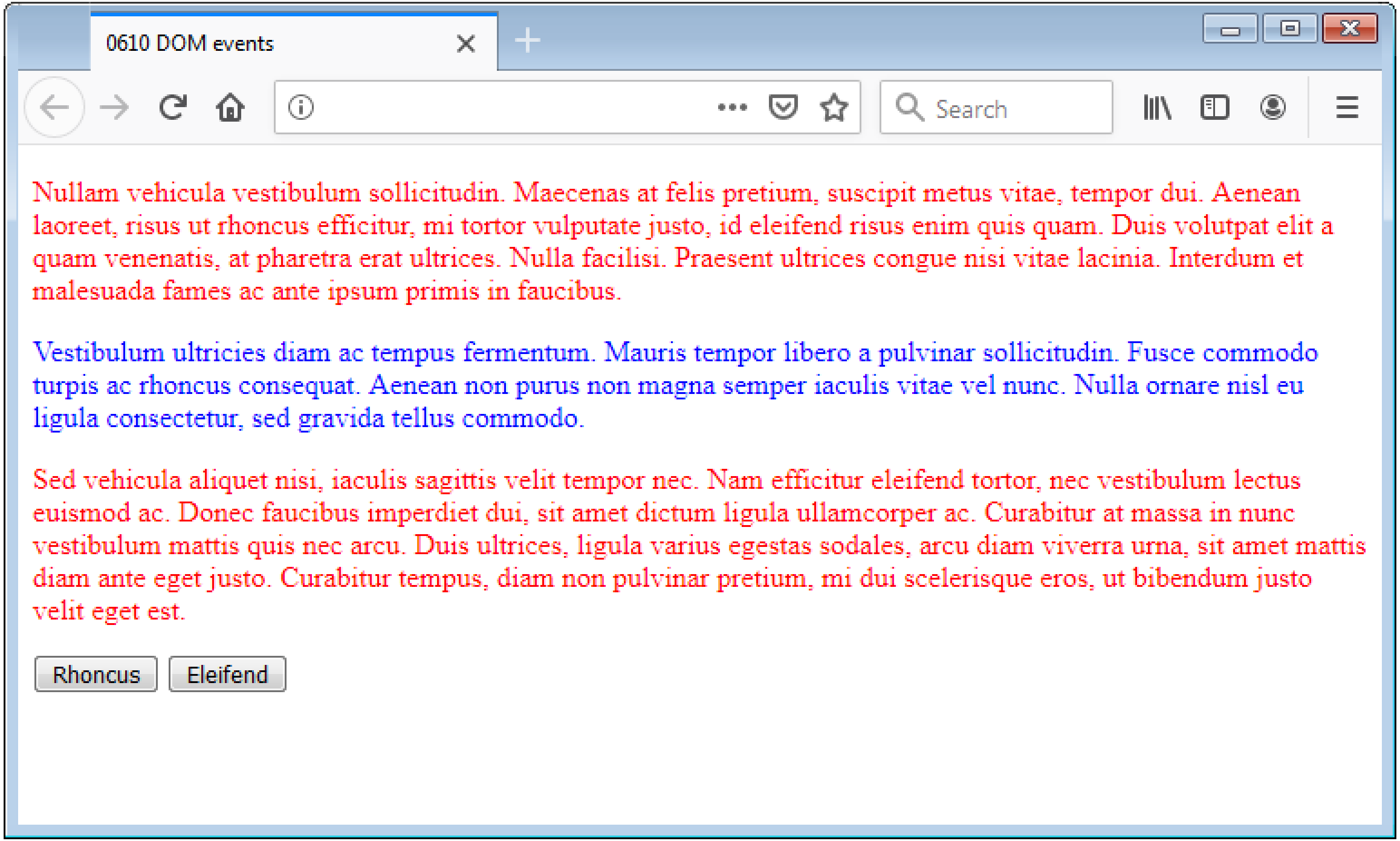
TRY IT

Using methods of the DOM element

- Providing a value for element method
- Using existing or anonymous function

```
b = document.getElementById('but1');
b.onclick = recolorAll;

b = document.getElementById('but2');
b.onclick = function ()
 {
   var p;
   p = document.getElementsByTagName('p');
   p[1].style.color='blue';
 };
```



Nullam vehicula vestibulum sollicitudin. Maecenas at felis pretium, suscipit metus vitae, tempor dui. Aenean laoreet, risus ut rhoncus efficitur, mi tortor vulputate justo, id eleifend risus enim quis quam. Duis volutpat elit a quam venenatis, at pharetra erat ultrices. Nulla facilisi. Praesent ultrices congue nisi vitae lacinia. Interdum et malesuada fames ac ante ipsum primis in faucibus.

Vestibulum ultricies diam ac tempus fermentum. Mauris tempor libero a pulvinar sollicitudin. Fusce commodo turpis ac rhoncus consequat. Aenean non purus non magna semper iaculis vitae vel nunc. Nulla ornare nisl eu ligula consectetur, sed gravida tellus commodo.

Sed vehicula aliquet nisi, iaculis sagittis velit tempor nec. Nam efficitur eleifend tortor, nec vestibulum lectus euismod ac. Donec faucibus imperdiet dui, sit amet dictum ligula ullamcorper ac. Curabitur at massa in nunc vestibulum mattis quis nec arcu. Duis ultrices, ligula varius egestas sodales, arcu diam viverra urna, sit amet mattis diam ante eget justo. Curabitur tempus, diam non pulvinar pretium, mi dui scelerisque eros, ut bibendum justo velit eget est.

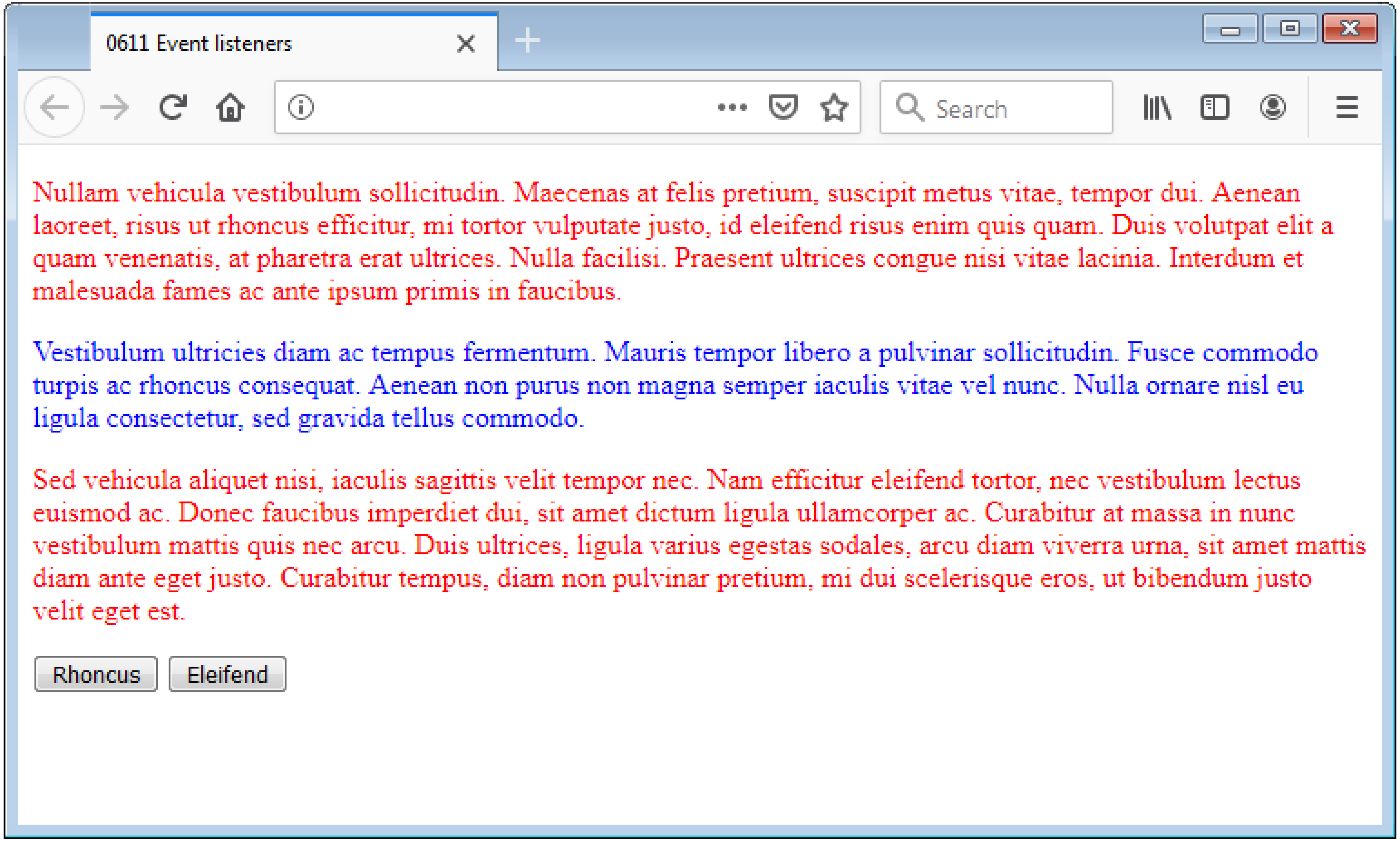
TRY IT

Using event listener

- Syntax element.addEventListener(event,function)
- The event name is without ‘on’ prefix
- The function could be named or unnamed

```
b = document.getElementById('but1');
b.addEventListener('click',recolorAll);

b = document.getElementById('but2');
b.addEventListener('click',function ()
{
  var p = document.getElementsByTagName('p');
  p[1].style.color='blue';
});
```



Nullam vehicula vestibulum sollicitudin. Maecenas at felis pretium, suscipit metus vitae, tempor dui. Aenean laoreet, risus ut rhoncus efficitur, mi tortor vulputate justo, id eleifend risus enim quis quam. Duis volutpat elit a quam venenatis, at pharetra erat ultrices. Nulla facilisi. Praesent ultrices congue nisi vitae lacinia. Interdum et malesuada fames ac ante ipsum primis in faucibus.

Vestibulum ultricies diam ac tempus fermentum. Mauris tempor libero a pulvinar sollicitudin. Fusce commodo turpis ac rhoncus consequat. Aenean non purus non magna semper iaculis vitae vel nunc. Nulla ornare nisl eu ligula consectetur, sed gravida tellus commodo.

Sed vehicula aliquet nisi, iaculis sagittis velit tempor nec. Nam efficitur eleifend tortor, nec vestibulum lectus euismod ac. Donec faucibus imperdiet dui, sit amet dictum ligula ullamcorper ac. Curabitur at massa in nunc vestibulum mattis quis nec arcu. Duis ultrices, ligula varius egestas sodales, arcu diam viverra urna, sit amet mattis diam ante eget justo. Curabitur tempus, diam non pulvinar pretium, mi dui scelerisque eros, ut bibendum justo velit eget est.

TRY IT

Examples

Questions and answers

The problem

- A list of questions and answers
- Initially all answers are hidden
- When a question is clicked, its answer is shown
- A second click hides the answer
- The number of questions and answers is not fixed

Implementation of questions and answers

- They will be in successive pairs of h3 and p elements

```
<h3>Q1. Fusce purus enim?</h3>
<p>Scelerisque sit amet aliquet vitae, … </p>
<h3>Q2. Mauris eros?</h3>
<p>Rutrum a elementum sed, volutpat a nisi. …</p>
```

- Styling with CSS, each h3 has a new cursor image to immitate a clickable link

```
h3 {    color: #000080;
        padding: 0.3em;
        cursor: pointer; }
p  {    margin: 0.25em auto 0.75em 2.5em; }
```

Initial hiding

- When the page is loaded all answers are hidden

```
<script>
   function main()
   {
      var p = document.getElementsByTagName('p');
      for (var i=0; i<p.length; i++)
         p[i].style.display = 'none';
   }
</script>

<body onload="main()">
</body>
```

Event processing

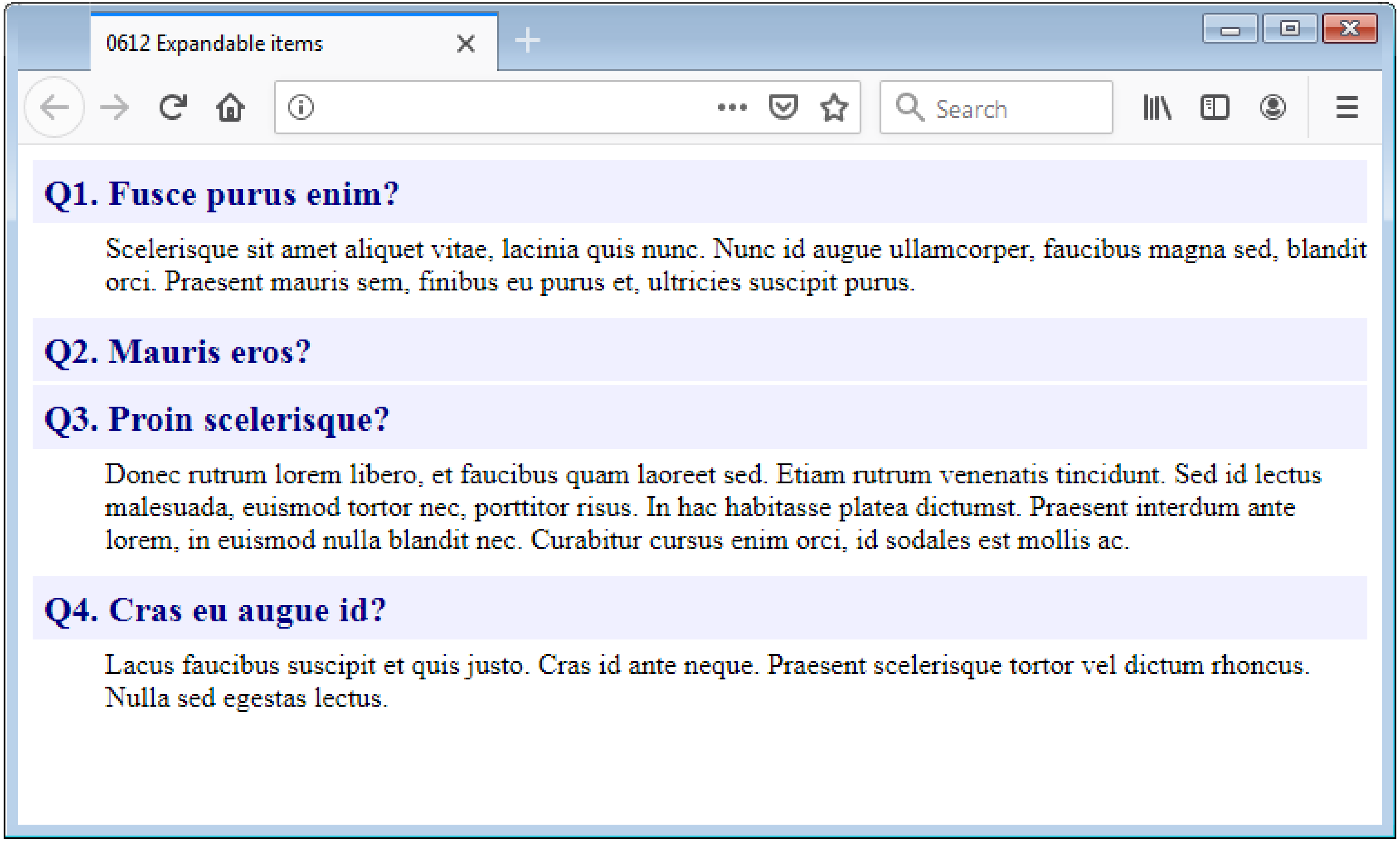
- Each DOM element of a question has a link to the DOM element of its answer

```
function main()
{
   var h = document.getElementsByTagName('h3');
   var p = document.getElementsByTagName('p');

   for (var i=0; i<p.length; i++)
   {
      p[i].style.display = 'none';
      h[i].elem = p[i];
   }
}
```

- The event listener of onclick, shows or hides an answer
- The event object contains data about the event
- Property target is the DOM element when the event happened, and elem is the stored DOM answer to show or hide

```
h[i].addEventListener('click',function(event)
  {
     var style = event.target.elem.style;
     if (style.display=='none')
       style.display = 'block';
     else
       style.display = 'none';
  });
```



Q1. Fusce purus enim?

Scelerisque sit amet aliquet vitae, lacinia quis nunc. Nunc id augue ullamcorper, faucibus magna sed, blandit orci. Praesent mauris sem, finibus eu purus et, ultricies suscipit purus.

Q2. Mauris eros?

Q3. Proin scelerisque?

Donec rutrum lorem libero, et faucibus quam laoreet sed. Etiam rutrum venenatis tincidunt. Sed id lectus malesuada, euismod tortor nec, porttitor risus. In hac habitasse platea dictumst. Praesent interdum ante lorem, in euismod nulla blandit nec. Curabitur cursus enim orci, id sodales est mollis ac.

Q4. Cras eu augue id?

Lacus faucibus suscipit et quis justo. Cras id ante neque. Praesent scelerisque tortor vel dictum rhoncus. Nulla sed egestas lectus.

TRY IT

Summary

Document object model

Object models

- BOM – Browser Object Model
- DOM – Document Object Model
- Programming access from JS to the web page and its elements
- Object {window.}document is the root of HTML elements

Working with elements

- Search by identifier, class or tag name
- Search for specific element or for all elements of a given type
- Setting the size of elements
- Access to elements’ content
- Reacting on events

Information

More information

- Elements and events in DOM:
  http://www.w3schools.com/jsref/dom_obj_document.asp
  http://www.w3schools.com/jsref/dom_obj_event.asp
  http://www.w3schools.com/jsref

ICT in SES

The end

Comments, questions