

# EECS 489 - Winter 2024

## Discussion 4

# Reminders

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- Assignment 2 is due February 23rd @ 11:59 pm EST

## START EARLY

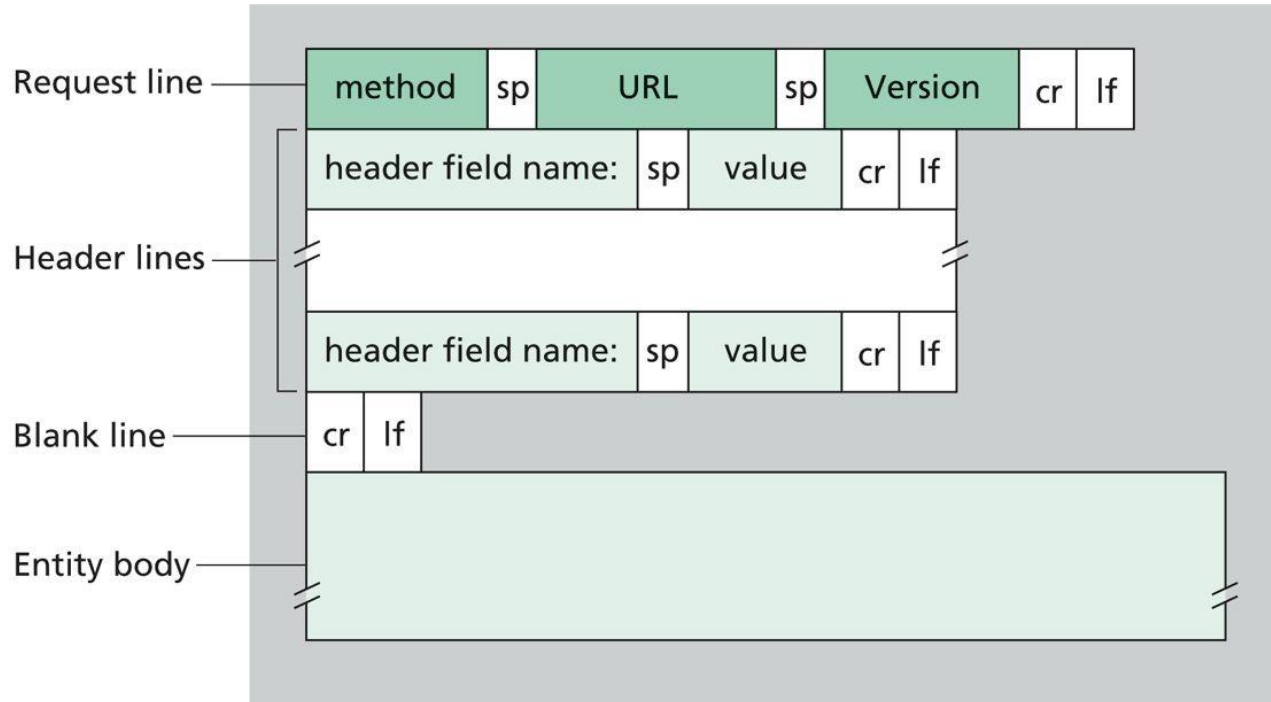
- This is considered the hardest project in the class
- 2 large components that can be done in parallel

# Today

— — —

- HTTP Request/Response Formats
- Practice Questions on HTTP

# HTTP Request



**Figure 2.8** ♦ General format of a request message

# HTTP Request

---

```
GET /doc/test.html HTTP/1.1
```

```
Host: www.test101.com
```

```
Accept: image/gif, image/jpeg, */*
```

```
Accept-Language: en-us
```

```
Accept-Encoding: gzip, deflate
```

```
User-Agent: Mozilla/4.0
```

```
Content-Length: 35
```

```
bookId=12345&author=Tan+Ah+Teck
```

Request Line

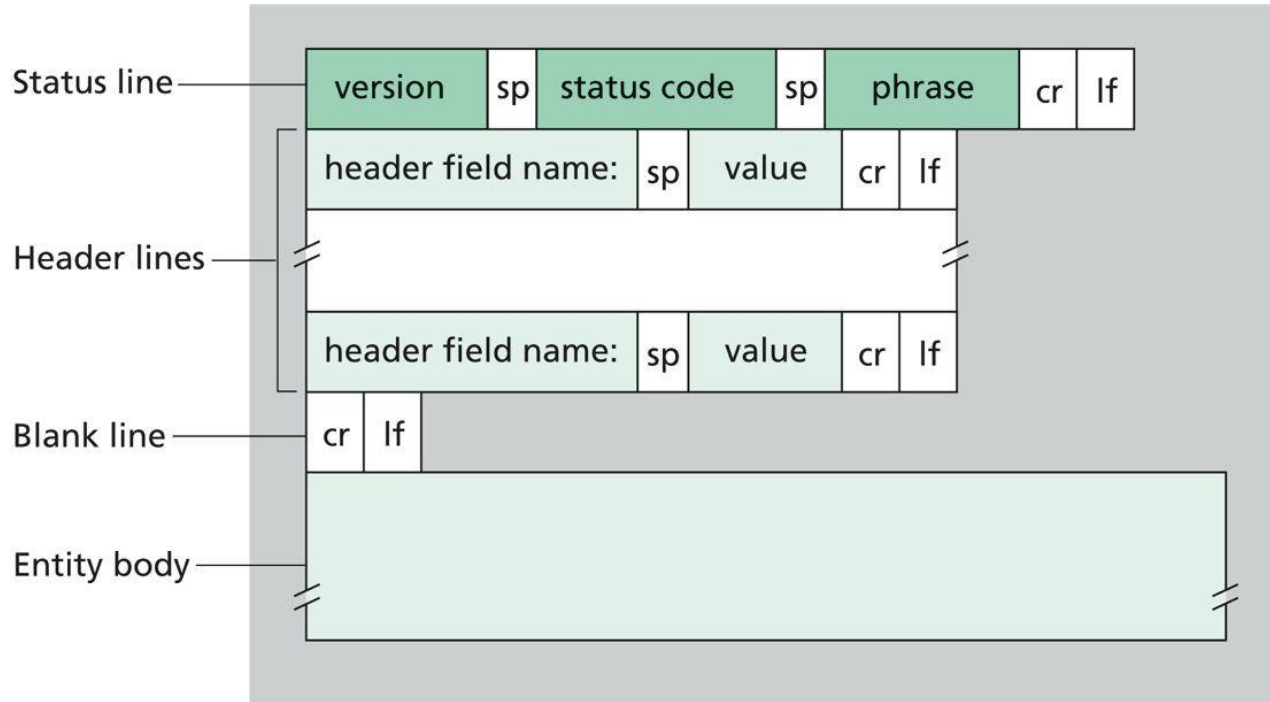
Request Headers

Request  
Message  
Header

A blank line separates header & body

Request Message Body

# HTTP Response



**Figure 2.9** ♦ General format of a response message

# HTTP Response

HTTP/1.1 200 OK

Access-Control-Allow-Origin: \*

Connection: Keep-Alive

Content-Encoding: gzip

Content-Type: text/html; charset=utf-8

Date: Wed, 10 Aug 2016 13:17:18 GMT

Etag: "d9b3b803e9a0dc6f22e2f20a3e90f69c41f6b71b"

Keep-Alive: timeout=5, max=999

Last-Modified: Wed, 10 Aug 2016 05:38:31 GMT

Server: Apache

Set-Cookie: csrftoken=.....

Transfer-Encoding: chunked

Vary: Cookie, Accept-Encoding

X-Frame-Options: DENY

Response headers

Representation  
headers

General headers

(body)

# Q1: True or False?

— — —

- HTTP Request messages **never** have an empty message body



# Q1: True or False?

— — —

- HTTP Request messages **never** have an empty message body
- False
- Some HTTP Request messages can have an empty body
  - Status Code 200 for HEAD request can be sent without message-body
  - Status Code 204 and 304 MUST NOT include a message body (RFC 2616)

## Q2: True or False?

— — —

- Two distinct web pages (for instance: [www.mit.edu/research.html](http://www.mit.edu/research.html) and [www.mit.edu/students.html](http://www.mit.edu/students.html)) can be sent over the same persistent connection.

## Q2: True or False?

---

- Two distinct web pages (for instance: [www.mit.edu/research.html](http://www.mit.edu/research.html) and [www.mit.edu/students.html](http://www.mit.edu/students.html)) can be sent over the same persistent connection.
- True.
- Both webpages are on the same physical server ([www.mit.edu](http://www.mit.edu))

## Q3: True or False?

---

- With a non-persistent connection between browser and the origin server, is it possible for a TCP segment to carry two distinct HTTP request messages?

## Q3: True or False?

---

- With a non-persistent connection between browser and the origin server, is it possible for a TCP segment to carry two distinct HTTP request messages?
- False.
- In a non-persistent connection, the connection closes after each request-response. For this situation, the connection closes after the first request/response, and then a second one will open for sending the second message.

# Q4: Examining an HTTP Request

— — —

- Given the HTTP Request to the right...
- What is the URL (without the scheme) of the document requested by the browser?

GET /cs453/index.html HTTP/1.1

Host: [gaia.cs.umass.edu](http://gaia.cs.umass.edu)

User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.7.2) Gecko/20040804 Netscape/7.2 (ax)

Accept: ext/xml, application/xml, application/xhtml+xml, text/html; q=0.9, text/plain; q=0.8, image/png, \*/\*; q=0.5

Accept-Language: en-us,en; q=0.5

Accept-Encoding: zip,deflate

Accept-Charset: ISO-8859-1,utf-8;q=0.7,\*;q=0.7

Keep-Alive: 300

Connection: keep-alive

# Q4: Examining an HTTP Request

---

- Given the HTTP Request to the right...
- What is the URL (without the scheme) of the document requested by the browser?
  - `gaia.cs.umass.edu/cs453/index.html`

```
GET /cs453/index.html HTTP/1.1\r\n
Host: gaia.cs.umass.edu\r\n
User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US;
rv:1.7.2) Gecko/20040804 Netscape/7.2 (ax)\r\n
Accept: ext/xml, application/xml, application/xhtml+xml, text/html;
q=0.9, text/plain; q=0.8, image/png, */*; q=0.5\r\n
Accept-Language: en-us,en; q=0.5\r\n
Accept-Encoding: zip,deflate\r\n
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7\r\n
Keep-Alive: 300\r\n
Connection: keep-alive\r\n\r\n
```

# Q4: Examining an HTTP Request

— — —

- Given the HTTP Request to the right...
- Does the browser request a persistent or a non-persistent connection?

```
GET /cs453/index.html HTTP/1.1\r\n
Host: gaia.cs.umass.edu\r\n
User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US;
rv:1.7.2) Gecko/20040804 Netscape/7.2 (ax)\r\n
Accept: ext/xml, application/xml, application/xhtml+xml, text/html;
q=0.9, text/plain; q=0.8, image/png, */*; q=0.5\r\n
Accept-Language: en-us,en; q=0.5\r\n
Accept-Encoding: zip,deflate\r\n
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7\r\n
Keep-Alive: 300\r\n
Connection: keep-alive\r\n\r\n
```



# Q4: Examining an HTTP Request

---

- Given the HTTP Request to the right...
- Does the browser request a persistent or a non-persistent connection?
  - Persistent

```
GET /cs453/index.html HTTP/1.1\r\nHost: gaia.cs.umass.edu\r\nUser-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.7.2) Gecko/20040804 Netscape/7.2 (ax)\r\nAccept: ext/xml, application/xml, application/xhtml+xml, text/html; q=0.9, text/plain; q=0.8, image/png, */*; q=0.5\r\nAccept-Language: en-us,en; q=0.5\r\nAccept-Encoding: zip,deflate\r\nAccept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7\r\nKeep-Alive: 300\r\nConnection: keep-alive\r\n\r\n
```

# Q4: Examining an HTTP Request

— — —

- Given the HTTP Request to the right...
- What type of browser initiates this message?

GET /cs453/index.html HTTP/1.1

Host: [gaia.cs.umass.edu](http://gaia.cs.umass.edu)

User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.7.2) Gecko/20040804 Netscape/7.2 (ax)

Accept: ext/xml, application/xml, application/xhtml+xml, text/html; q=0.9, text/plain; q=0.8, image/png, \*/\*; q=0.5

Accept-Language: en-us,en; q=0.5

Accept-Encoding: zip,deflate

Accept-Charset: ISO-8859-1,utf-8;q=0.7,\*;q=0.7

Keep-Alive: 300

Connection: keep-alive

# Q4: Examining an HTTP Request

---

- Given the HTTP Request to the right...
- What type of browser initiates this message?
  - Mozilla/5.0

```
GET /cs453/index.html HTTP/1.1\r\n
Host: gaia.cs.umass.edu\r\n
User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US;
rv:1.7.2) Gecko/20040804 Netscape/7.2 (ax)\r\n
Accept: ext/xml, application/xml, application/xhtml+xml, text/html;
q=0.9, text/plain; q=0.8, image/png, */*; q=0.5\r\n
Accept-Language: en-us,en; q=0.5\r\n
Accept-Encoding: zip,deflate\r\n
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7\r\n
Keep-Alive: 300\r\n
Connection: keep-alive\r\n\r\n
```

# Q4: Examining an HTTP Request

— — —

- Given the HTTP Request to the right...
- Follow-Up: Why is browser type needed in an HTTP request message?

```
GET /cs453/index.html HTTP/1.1\r\n
Host: gaia.cs.umass.edu\r\n
User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US;
rv:1.7.2) Gecko/20040804 Netscape/7.2 (ax)\r\n
Accept: ext/xml, application/xml, application/xhtml+xml, text/html;
q=0.9, text/plain; q=0.8, image/png, */*; q=0.5\r\n
Accept-Language: en-us,en; q=0.5\r\n
Accept-Encoding: zip,deflate\r\n
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7\r\n
Keep-Alive: 300\r\n
Connection: keep-alive\r\n\r\n
```

# Q4: Examining an HTTP Request

---

- Given the HTTP Request to the right...
- Follow-Up: Why is browser type needed in an HTTP request message?
  - Multiple Reasons: Data format, ability to render objects due to different library versions, etc.

```
GET /cs453/index.html HTTP/1.1\r\n
Host: gaia.cs.umass.edu\r\n
User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US;
rv:1.7.2) Gecko/20040804 Netscape/7.2 (ax)\r\n
Accept: ext/xml, application/xml, application/xhtml+xml, text/html;
q=0.9, text/plain; q=0.8, image/png, */*; q=0.5\r\n
Accept-Language: en-us,en; q=0.5\r\n
Accept-Encoding: zip,deflate\r\n
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7\r\n
Keep-Alive: 300\r\n
Connection: keep-alive\r\n\r\n
```

# Q5: Examining an HTTP Response

— — —

- Given the HTTP Response to the right...
- Did the server successfully find the document?

```
HTTP/1.1 200 OK\r\n
Date: Tue, 07 Mar 2008 12:39:45GMT\r\n
Server: Apache/2.0.52 (Fedora)\r\n
Last-Modified: Sat, 10 Dec 2005 18:27:46 GMT\r\n
ETag: "526c3-f22-a88a4c80"\r\n
Accept-Ranges: bytes\r\n
Content-Length: 3874\r\n
Keep-Alive: timeout=max=100\r\n
Connection: Keep-Alive\r\n
Content-Type: text/html; charset=ISO-8859-1\r\n\r\n
<!doctype html public "-//w3c//dtd html 4.0
transitional//en">\r\n
<html>\r\n
<head>\r\n
<meta http-equiv="Content-Type" content="text/html;
charset=iso-8859-1">\r\n
<meta name="GENERATOR" content="Mozilla/4.79 [en]
(Windows NT 5.0; U) Netscape]">\r\n
<title>CMPSCI 453/591/NTU-ST550A Spring 2005
homepage</title>\r\n
</head>\r\n
<much more document text following here (not shown)>
```

# Q5: Examining an HTTP Response

— — —

- Given the HTTP Response to the right...
- Did the server successfully find the document?
  - Yes

```
HTTP/1.1 200 OK\r\n
Date: Tue, 07 Mar 2008 12:39:45GMT\r\n
Server: Apache/2.0.52 (Fedora)\r\n
Last-Modified: Sat, 10 Dec 2005 18:27:46 GMT\r\n
ETag: "526c3-f22-a88a4c80"\r\n
Accept-Ranges: bytes\r\n
Content-Length: 3874\r\n
Keep-Alive: timeout=max=100\r\n
Connection: Keep-Alive\r\n
Content-Type: text/html; charset=ISO-8859-1\r\n\r\n
<!doctype html public "-//w3c//dtd html 4.0
transitional//en">\r\n
<html>\r\n
<head>\r\n
<meta http-equiv="Content-Type" content="text/html;
charset=iso-8859-1">\r\n
<meta name="GENERATOR" content="Mozilla/4.79 [en]
(Windows NT 5.0; U) Netscape]">\r\n
<title>CMPSCI 453/591/NTU-ST550A Spring 2005
homepage</title>\r\n
</head>\r\n
<much more document text following here (not shown)>
```

# Q5: Examining an HTTP Response

— — —

- Given the HTTP Response to the right...
- How many bytes are being returned in the document?

```
HTTP/1.1 200 OK\r\n
Date: Tue, 07 Mar 2008 12:39:45GMT\r\n
Server: Apache/2.0.52 (Fedora)\r\n
Last-Modified: Sat, 10 Dec 2005 18:27:46 GMT\r\n
ETag: "526c3-f22-a88a4c80"\r\n
Accept-Ranges: bytes\r\n
Content-Length: 3874\r\n
Keep-Alive: timeout=max=100\r\n
Connection: Keep-Alive\r\n
Content-Type: text/html; charset=ISO-8859-1\r\n\r\n
<!doctype html public "-//w3c//dtd html 4.0
transitional//en">\r\n
<html>\r\n
<head>\r\n
<meta http-equiv="Content-Type" content="text/html;
charset=iso-8859-1">\r\n
<meta name="GENERATOR" content="Mozilla/4.79 [en]
(Windows NT 5.0; U) Netscape]">\r\n
<title>CMPSCI 453/591/NTU-ST550A Spring 2005
homepage</title>\r\n
</head>\r\n
<much more document text following here (not shown)>
```



# Q5: Examining an HTTP Response

— — —

- Given the HTTP Response to the right...
- How many bytes are being returned in the document?
  - 3874 bytes

```
HTTP/1.1 200 OK\r\n
Date: Tue, 07 Mar 2008 12:39:45GMT\r\n
Server: Apache/2.0.52 (Fedora)\r\n
Last-Modified: Sat, 10 Dec 2005 18:27:46 GMT\r\n
ETag: "526c3-f22-a88a4c80"\r\n
Accept-Ranges: bytes\r\n
Content-Length: 3874\r\n
Keep-Alive: timeout=max=100\r\n
Connection: Keep-Alive\r\n
Content-Type: text/html; charset=ISO-8859-1\r\n\r\n
<!doctype html public "-//w3c//dtd html 4.0
transitional//en">\r\n
<html>\r\n
<head>\r\n
<meta http-equiv="Content-Type" content="text/html;
charset=iso-8859-1">\r\n
<meta name="GENERATOR" content="Mozilla/4.79 [en]
(Windows NT 5.0; U) Netscape]">\r\n
<title>CMPSCI 453/591/NTU-ST550A Spring 2005
homepage</title>\r\n
</head>\r\n
<much more document text following here (not shown)>
```

# Q5: Examining an HTTP Response

— — —

- Given the HTTP Response to the right...
- What are the first 5 bytes of the document being returned?

```
HTTP/1.1 200 OK\r\n
Date: Tue, 07 Mar 2008 12:39:45GMT\r\n
Server: Apache/2.0.52 (Fedora)\r\n
Last-Modified: Sat, 10 Dec 2005 18:27:46 GMT\r\n
ETag: "526c3-f22-a88a4c80"\r\n
Accept-Ranges: bytes\r\n
Content-Length: 3874\r\n
Keep-Alive: timeout=max=100\r\n
Connection: Keep-Alive\r\n
Content-Type: text/html; charset=ISO-8859-1\r\n\r\n
<!doctype html public "-//w3c//dtd html 4.0
transitional//en">\r\n
<html>\r\n
<head>\r\n
<meta http-equiv="Content-Type" content="text/html;
charset=iso-8859-1">\r\n
<meta name="GENERATOR" content="Mozilla/4.79 [en]
(Windows NT 5.0; U) Netscape]">\r\n
<title>CMPSCI 453/591/NTU-ST550A Spring 2005
homepage</title>\r\n
</head>\r\n
<much more document text following here (not shown)>
```

# Q5: Examining an HTTP Response

— — —

- Given the HTTP Response to the right...
- What are the first 5 bytes of the document being returned?
  - `<!doc`

```
HTTP/1.1 200 OK\r\n
Date: Tue, 07 Mar 2008 12:39:45GMT\r\n
Server: Apache/2.0.52 (Fedora)\r\n
Last-Modified: Sat, 10 Dec 2005 18:27:46 GMT\r\n
ETag: "526c3-f22-a88a4c80"\r\n
Accept-Ranges: bytes\r\n
Content-Length: 3874\r\n
Keep-Alive: timeout=max=100\r\n
Connection: Keep-Alive\r\n
Content-Type: text/html; charset=ISO-8859-1\r\n\r\n
<!doctype html public "-//w3c//dtd html 4.0
transitional//en">\r\n
<html>\r\n
<head>\r\n
<meta http-equiv="Content-Type" content="text/html;
charset=iso-8859-1">\r\n
<meta name="GENERATOR" content="Mozilla/4.79 [en]
(Windows NT 5.0; U) Netscape]">\r\n
<title>CMPSCI 453/591/NTU-ST550A Spring 2005
homepage</title>\r\n
</head>\r\n
<much more document text following here (not shown)>
```

# Q5: Examining an HTTP Response

— — —

- Given the HTTP Response to the right...
- Did the server agree to a persistent connection?

```
HTTP/1.1 200 OK\r\n
Date: Tue, 07 Mar 2008 12:39:45GMT\r\n
Server: Apache/2.0.52 (Fedora)\r\n
Last-Modified: Sat, 10 Dec 2005 18:27:46 GMT\r\n
ETag: "526c3-f22-a88a4c80"\r\n
Accept-Ranges: bytes\r\n
Content-Length: 3874\r\n
Keep-Alive: timeout=max=100\r\n
Connection: Keep-Alive\r\n
Content-Type: text/html; charset=ISO-8859-1\r\n\r\n
<!doctype html public "-//w3c//dtd html 4.0
transitional//en">\r\n
<html>\r\n
<head>\r\n
<meta http-equiv="Content-Type" content="text/html;
charset=iso-8859-1">\r\n
<meta name="GENERATOR" content="Mozilla/4.79 [en]
(Windows NT 5.0; U) Netscape]">\r\n
<title>CMPSCI 453/591/NTU-ST550A Spring 2005
homepage</title>\r\n
</head>\r\n
<much more document text following here (not shown)>
```

# Q5: Examining an HTTP Response

— — —

- Given the HTTP Response to the right...
- Did the server agree to a persistent connection?
  - Yes

```
HTTP/1.1 200 OK\r\n
Date: Tue, 07 Mar 2008 12:39:45GMT\r\n
Server: Apache/2.0.52 (Fedora)\r\n
Last-Modified: Sat, 10 Dec 2005 18:27:46 GMT\r\n
ETag: "526c3-f22-a88a4c80"\r\n
Accept-Ranges: bytes\r\n
Content-Length: 3874\r\n
Keep-Alive: timeout=max=100\r\n
Connection: Keep-Alive\r\n
Content-Type: text/html; charset=ISO-8859-1\r\n\r\n
<!doctype html public "-//w3c//dtd html 4.0
transitional//en">\r\n
<html>\r\n
<head>\r\n
<meta http-equiv="Content-Type" content="text/html;
charset=iso-8859-1">\r\n
<meta name="GENERATOR" content="Mozilla/4.79 [en]
(Windows NT 5.0; U) Netscape]">\r\n
<title>CMPSCI 453/591/NTU-ST550A Spring 2005
homepage</title>\r\n
</head>\r\n
<much more document text following here (not shown)>
```

## Q6: Sending Objects

---

- You request a very small HTML file from a server. This HTML references 8 other very small objects. Let  $X$  denote the RTT between localhost and the server. How much time elapses with:
1. Non-persistent HTTP with no parallel TCP connections

## Q6: Sending Objects

---

- You request a very small HTML file from a server. This HTML references 8 other very small objects. Let  $X$  denote the RTT between localhost and the server. How much time elapses with:
  1. Non-persistent HTTP with no parallel TCP connections
    - a. Each object needs its own connection, and none are in parallel. This means we it will take  $9 * 2X = 18X$

## Q6: Sending Objects

---

- You request a very small HTML file from a server. This HTML references 8 other very small objects. Let  $X$  denote the RTT between localhost and the server. How much time elapses with:
2. Non-persistent HTTP with a browser configured for 5 parallel connections



## Q6: Sending Objects

---

- You request a very small HTML file from a server. This HTML references 8 other very small objects. Let  $X$  denote the RTT between localhost and the server. How much time elapses with:
2. Non-persistent HTTP with a browser configured for 5 parallel connections
    - a. Since we have non-persistent but parallel connections, we need  $2X$  for the initial file, which then will reference the 8 smaller objects. From there, we need  $2X$  for the first 5 objects (done in parallel), then another for the other 3 (done in parallel). This means the elapsed time is  $3 * 2X = 6X$ .

## Q6: Sending Objects

---

- You request a very small HTML file from a server. This HTML references 8 other very small objects. Let  $X$  denote the RTT between localhost and the server. How much time elapses with:
3. Persistent HTTP with pipelining

## Q6: Sending Objects

---

- You request a very small HTML file from a server. This HTML references 8 other very small objects. Let  $X$  denote the RTT between localhost and the server. How much time elapses with:

### 3. Persistent HTTP with pipelining

- a. We need  $2X$  for the initial connection and HTML file. Then  $X$  for the 8 files that are referenced. (since we don't need to perform another connection setup that would usually take another  $X$ ) The time elapsed is  $2X + X = 3X$

# Wrap-Up

— — —

- Thanks for coming!
- Start/Continue to work on Assignment 2!