

ECE363 Assignment 5 Solutions

Student ID:

Student Name:

1. For a simplified HTML document with URL `http://a.b.com/index.html`

```
<html>
<a href="image/fig1-big.jpg">  </a>


</html>
```

For a web browser that loads images (JPEG and GIF files) automatically, how many TCP connections will be opened by the browser to display this Web page properly, and:

(a) non-persistent HTTP connections are used, or

Ans : 4 connections (1 for the HTML file and 3 for the 3 images).

(b) persistent HTTP connections with non-pipelining are used, or

Ans : 2 connections (1 connection to each server).

(c) persistent HTTP connections with pipelining are used.

Ans : 2 connections (1 connection to each server).

2. For a simplified HTML document with URL `http://a.b.com/index.html`

```
<html>
<a href="image/fig1-big.jpg">  </a>


</html>
```

For a web browser that loads images (JPEG and GIF files) automatically, how long (in round-trip time) does it take to display this Web page properly (DNS overhead is omitted), if all files are small enough to be accommodated in one packet, and:

(i) non-persistent HTTP connections are used, or

(ii) persistent HTTP connections with non-pipelining are used, or

(iii) persistent HTTP connections with pipelining are used.

The web-browser may or may not use parallel TCP connections to speed up the download speed. We consider the following cases separately.

i) nonpersistent, no parallel TCP:

For each TCP connection, the first round-trip time is used to exchange two hand-shake packets. The ACK to the 2nd handshake packet can be piggy-backed in the request from the client. So, it takes two RTTs for each object and the HTML file.

→ totally 8 RTTs

ii) nonpersistent, with parallel TCP connections:

2RTTs for HTML plus 2 RTTs for the 3 objects requested with parallel TCP connections

→ totally 4 RTTs

iii) persistent, non-pipeline, no parallel TCP:

2RTTs for HTML. 2 RTTs for 2 objects in the same server, 2 RTTs for the object in the other server

→ 6 RTTs

persistent, non-pipeline, with parallel TCP connections to different servers:

2 RTTs for HTML. 2 RTTs for 2 objects in the same server; at the same time, 2 RTTs for the object in the other server

→ 4 RTTs

iv) persistent, pipeline, no parallel TCP:

2 RTTs for HTML. 1 RTT for 2 objects in the same server, 2 RTTs for the object in the other server

→ 5 RTTs

persistent, pipeline, parallel TCP connections to different servers:

2 RTTs for HTML. 1 RTT for 2 objects in the same server; at the same time, 2 RTTs for the object in the other server

→ 4 RTTs