CMPT 371: Solutions to Homework 1

February 1, 2007

Problem 1:

(a) Let d_Q denote the average queueing delay. Then, the equation

$$d_Q = \frac{1}{1 - La/R} - 1$$

approximately fits the curve. Other acceptable answers include $\left(\frac{1}{1-La/R}\right)^2 - 1$ or $\frac{La/R}{1-La/R}$.

(b) We want $d_{trans} > d_Q$, or $L/R > \frac{1}{1-La/R} - 1$. Solving for a, we get

$$a > \frac{1}{1 + L/R}.$$

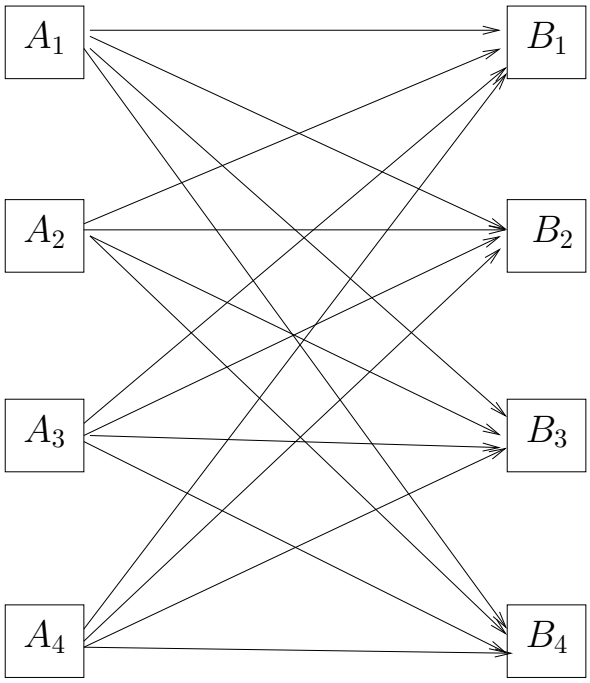
(c) We want $d_{prop} > d_Q + d_{trans}$, or $M/3 \times 10^8 > \frac{1}{1-La/R} - 1 + L/R$, so

$$M > 3 \times 10^8 \left(\frac{1}{1 - La/R} - 1 + L/R \right).$$

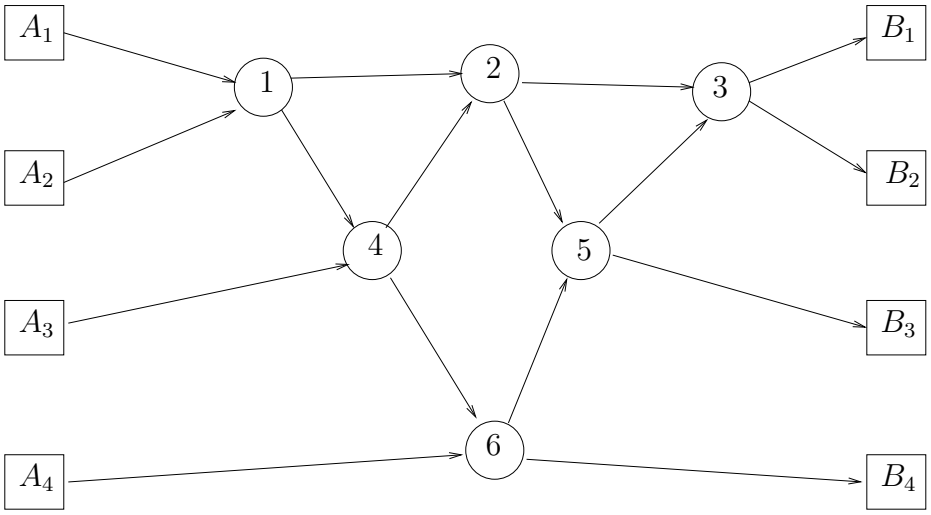
(d) $d_{prop} = 5000 \times 10^3 / 3 \times 10^8 = \frac{5}{3} \times 10^{-2}$ seconds.
$d_{trans} = 1000/100 \times 10^6 = 10^{-5}$ seconds.
$La/R = 10^{-5} \times 100 = 10^{-3}$, so $d_Q = \frac{1}{1-10^{-3}} - 1 \approx 10^{-3}$ seconds.

Problem 2:

(a) One way to do it is with the following network that has 16 links and no switches:



Another way is with the following network that has 16 links and 6 switches:



Ideally, there should be a network that uses switches and has fewer than 16 links. If you found one, great!

(b) Consider the second network from part (a) and the fourway connection that connects A_i to B_i for each $i \in \{1, .., 4\}$. Each (A_i, B_i) pair uses a single path and no two pairs share a link in their path. Each link can handle R/L pkts/sec. Hence, there will be no queueing delay. Consider the longest path in the fourway connection: the path from A_2 to B_2 might go through switches 1,4,2,5,3, in that order. When A_2 sends its single packet, it takes L/R seconds (plus a small propagation delay) before it is all received at switch 1. Only then can switch 1 forward it to switch 4, etc. In total, that packet takes $6(L/R)$ seconds to get to B_2, so the average arrival rate at B is $R/6$ bits/second (much slower than in the circuit-switched network).

Problem 3:

If you could not connect to a mail server, you should explain why you think it didn't let you. For example, how does the mail server know you're not another mail server trying to deliver mail to someone in its domain? The server mail.sfu.ca consistently let me connect from within the sfu.ca domain.

```
jburesho421: telnet mail.sfu.ca 25
Trying 142.58.101.21...
Connected to mail.sfu.ca.
Escape character is '^]'.
220 rm-rstar.sfu.ca ESMTP Sendmail 8.13.6/8.13.4/SFU-5.0H; Thu, 1 Feb 2007 14:58:43 -0800 (I
HELO mail.sfu.ca
250 rm-rstar.sfu.ca Hello cmpt03.cs.sfu.ca [199.60.11.135], pleased to meet you
MAIL FROM: <angelina.jolie@hollywood.org>
250 2.1.0 <angelina.jolie@hollywood.org>... Sender ok
RCPT TO: <bureshop@gmail.com>
250 2.1.5 <bureshop@gmail.com>... Recipient ok
DATA
354 Enter mail, end with "." on a line by itself
I think you're swell!
.
250 2.0.0 l11Mwh9h002505 Message accepted for delivery
QUIT
221 2.0.0 rm-rstar.sfu.ca closing connection
```

As you can see, the smtp server did allow a message from an address outside the domain to another address outside the domain. One reason it might allow this is because sometimes mail gets relayed by an intermediate mail server (that is, not the sender's nor the receiver's server). One reason it might not want to allow this is because it could be used by illegitimate users (such as spammers) to send out lots of email that is harder to trace. The server can also prevent this by disallowing logins from outside the domain as it seems to do.

Problem 4: One possible way to go about this is to telnet to www.amazon.com and issue a GET command as follows:

```
jburesho41: telnet www.amazon.com 80
Trying 72.21.210.11...
Connected to www.amazon.com.
Escape character is '^]'.
GET / HTTP/1.1
Host: www.amazon.com

HTTP/1.1 200 OK
Date: Thu, 01 Feb 2007 23:39:49 GMT
Server: Server
Set-Cookie: skin=noskin; path=/; domain=.amazon.com; expires=Thu, 01-Feb-2007 23:39:49 GMT
x-amz-id-1: 081AEXACV2QWN24FKGT4
x-amz-id-2: Yb5a+pKkWopch8+VGMfYg5GpONm/0V6w
```

```
Set-cookie: session-id-time=11709216001; path=/; domain=.amazon.com; expires=Thu Feb 08 08:0
Set-cookie: session-id=104-4441731-8587909; path=/; domain=.amazon.com; expires=Thu Feb 08 0
Vary: Accept-Encoding,User-Agent
Content-Type: text/html; charset=ISO-8859-1
nnCoection: close
Transfer-Encoding: chunked

.
. data
.
```

Notice that the response http message includes a few `set-cookie` lines. Once you see the format of the cookies it assigns you, you could try to guess a different valid set of cookies x1, x2, x3 and issue another GET command that includes the header `cookie: xi` for each i. The server will then recognize you as the user who has cookies x1, x2, x3 and will return a webpage including the recommendations for that user.