

ECE 50863 HOMEWORK 1

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QUESTION 1

(a) Time for one packet = Transmission delay + Propagation delay

$$= (\text{Packet size}/\text{Bandwidth}) + (\text{RTT}/2)$$

$$= \frac{1000}{\frac{1.5}{8} \times 10^6} + 25 \times 10^{-3} \text{ s}$$

$$= 30.3 \text{ ms}$$

$$\text{Time for all packets} = 30.3 \times (1000 \text{ KB}/1 \text{ KB}) = 30.3 \text{ s}$$

$$\text{Time for initial handshake} = 2 \times \text{RTT} = 100 \text{ ms}$$

$$\text{Total time} = 30.3 + 0.1 = \underline{30.4 \text{ s}}$$

(b) Time for one packet = Transmission delay + Propagation delay + Wait time

$$= \frac{1000}{\frac{1.5}{8} \times 10^6} + 25 \times 10^{-3} + 50 \times 10^{-3} \text{ s}$$

$$= 80.3 \text{ ms}$$

$$\text{Time for all packets} = 1000 \times 80.3 \text{ ms} + 2 \times 50 \text{ ms} = \underline{80.4 \text{ s}}$$

QUESTION 2

(a) $\text{RTT} \geq 2 \times \text{Propagation delay}$

$$\text{RTT} \geq 2 \times (385 \times 10^6) / (3 \times 10^8) = \underline{2.56 \text{ s}}$$

$$\text{(b) Delay} \times \text{Bandwidth} = \underline{2.56 \times 10^9 \text{ Gb}}$$

(c) This is the maximum number of bits that could be sent in a packet

$$\text{(d) Time for the request (assuming packet is very small)} = \text{RTT}/2 = 2.56/2 = 1.28 \text{ s}$$

$$\text{Time for the data} = \text{Transmission delay} + \text{Propagation delay}$$

$$= (25 \times 10^6 / (1/8) \times 10^9) + 1.28 = \underline{1.48 \text{ s}}$$

QUESTION 3

(i) In circuit switching, only one connection can be serviced. Hence one requires 10% of the time, maximum number of users (assuming this is the same as one connection) is 10

(ii) One user requires 100kbps.

Hence, number of simultaneous users = $1\text{Mbps}/100\text{kbps} = 1000/100 = 10$

QUESTION 4

For collision detection,

$$(\text{minimum frame size}/\text{bandwidth}) > 2 * \text{Propagation delay}$$

$$1000/(100 \times 10^6) > 2 \times \text{length}/(2 \times 10^8)$$

$$1000 > \text{length}$$

Therefore, maximum length of the wire is 1000m

QUESTION 5

(a) After the i^{th} collision, the wait period is between 0 and $2^i - 1$ time units.

This is the first collision. Hence $i=1$.

Hence, wait period is between 0 and $(2-1) \rightarrow 0$ and 1

- (i) Hence, possible combinations: $\langle 0,0 \rangle, \langle 0,1 \rangle, \langle 1,0 \rangle, \langle 1,1 \rangle$
- (ii) $\langle 0,1 \rangle$

(b) This is the second collision for both A and B. Hence, $i=2$.

Hence, wait period is between 0 and $2^2 - 1 \rightarrow 0$ and 3

- (i) Hence, possible combinations:
 $\langle 0,0 \rangle, \langle 0,1 \rangle, \langle 0,2 \rangle, \langle 0,3 \rangle, \langle 1,0 \rangle, \langle 1,1 \rangle, \langle 1,2 \rangle, \langle 1,3 \rangle, \langle 2,0 \rangle, \langle 2,1 \rangle, \langle 2,2 \rangle, \langle 2,3 \rangle,$
 $\langle 3,0 \rangle, \langle 3,1 \rangle, \langle 3,2 \rangle, \langle 3,3 \rangle$
- (ii) $\langle 0,1 \rangle, \langle 0,2 \rangle, \langle 0,3 \rangle, \langle 1,2 \rangle, \langle 1,3 \rangle, \langle 2,3 \rangle$

QUESTION 6

After applying the spanning tree algorithm, B1 is chosen as the root node.

Hence, ports (links) not chosen are: <A, B2>, <B, B5>, <I, B6>

QUESTION 7

Assumption: The transmissions occur one after another

Message	B1		B2			B3		B4	
	1	2	1	2	3	1	2	1	2
D to C	D		D			D		D	
C to D	D		D	C		D	C	D	C
A to C	D	A	D	C	A	D, A	C	D	C

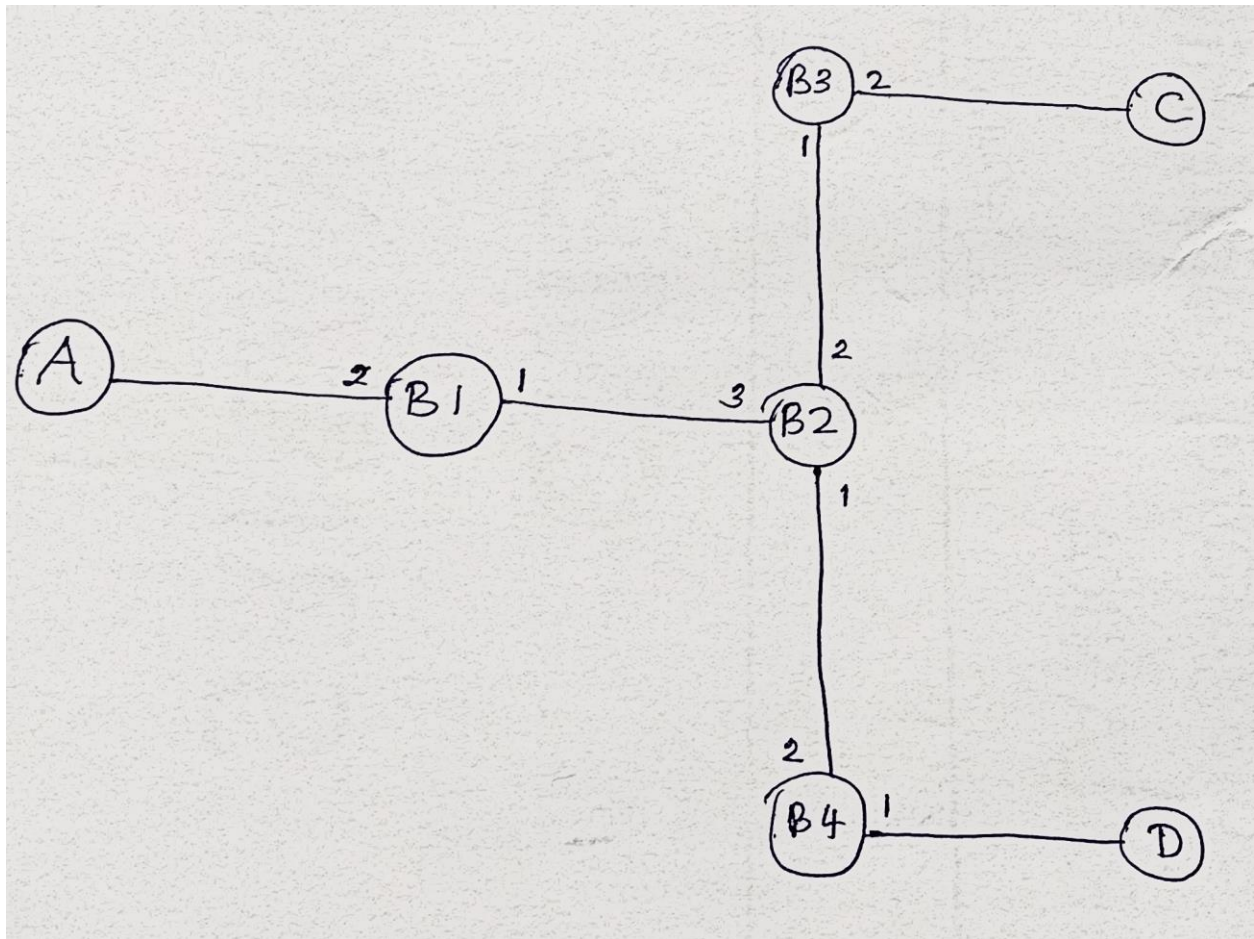


Figure 1: Port numbers