CS408-HW1

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1st Question

a)

Probability of a message gets delivered, $P(d) = 0.70$

Probability of a message doesn't get delivered, $1-P(d) = 0.30$

Ali Sends n, Banu Sends m Messages.

For both to go to the meeting, Banu must receive at least one of Ali's messages and Ali must receive at least one of Banu's acknowledgment messages.

Probability of Banu doesn't receive any of Ali's messages $(0.30)^n$. Subtract this probability from the whole probability (1) we get the probability of at least one of Ali's messages is received by Banu, $1-(0.30)^n$.

In the same logic, the probability of Ali receives at least one of Banu's acknowledgments is $1-(0.30)^m$.

So, the probability of both receiving at least one message from each other is

$(1-(0.30)^n) \times (1-(0.30)^m)$ and this means both went to the meeting.

b)

Banu must receive at least one message = $1 - (0.30)^n$

Ali doesn't receive any message = 0.30^m

(How we got these probabilities is explained in part a)

$(1-(0.30)^n) \times (0.30^m)$ → probability of Banu goes, Ali doesn't.

c) This can't happen because for Ali to go to the meeting, he must receive an acknowledgment message from Banu and for Banu to send a message to Ali, she must first receive a message from him, and if she does receive a message she must come. So, this scenario is not possible because it is a paradox. So, probability is 0.

d) As we explained in d, if Banu doesn't receive any messages from Ali, she can't send an acknowledgment message, so Ali won't come and because she didn't receive any messages, Banu won't come too. So, both won't come. The probability of Banu doesn't receive any messages is $(0.30)^n$ is also the probability of both doesn't come.

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2nd Question

File size = 1,000,000 bits

Packet size (data part) = 50,000

Packet size (total) = 50,000 + 2,800 = 52,800

Amount of packets = 1,000,000 / 50,000 = 20 packets

For A-x-B path:

A to x: 52,800 /4,800 = 11 seconds for one packet

x to B: 52,800 /1,200 = 44 seconds for one packet

As soon as x receives a one whole packet, it starts to travel to B. So, at t = 11, the first journey of x to B will start and it will be completed at t = 55. In t = 55, 5 packets have completed their A-x journeys and 1 packet has completed its x-B journey.

We can see the limiting factor in this problem is x-B path because A-x is faster so there will always be enough data for x-B to process non-stop therefore we need to analyze the time it takes for x-B path to transfer all packets. 1st packet is transferred, and it took 55 seconds, 19 packets have left, and it would take 44 x 19 = 836 seconds to transfer them + 1st packet transfer time (55) is 836+55 = 891 seconds (A-x-B)

For A-y-B:

A to y 52,800 /1,200 = 44 seconds for one packet

y to B 52,800 /2,400 = 22 seconds for one packet

y to B is faster than A to y. So, after the first package is arrived from A to B, y-B path will not be occupied for 22 seconds for each data transfer because it hasn't received any input from A-Y. We can say the determining path is A-Y because it is slower. So, the first package is transferred in 66 seconds then after that it takes 44 seconds for each data to be transferred so, 44×19 + 66 = 902 seconds (A-y-B)

Finally:

A-x-B: 891 seconds for all 20 packages to get transferred.

A-y-B: 902 seconds for all 20 packages to get transferred.

A-x-B is faster.

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3rd Question

Packet size = 6.000

Link capacity = 12.000

Transmission time = 6.000/12.000 = 0.5 seconds to send 1 packet over the link

Propagation time (for one bit to travel from one end to the other) = 150km/300.000km = 0.0005 seconds

Total transmission time to send 3 packets consecutively = (3 x 0.5) + 2 x 0.02(delay between packets) = 1.54

Total time so send acknowledgement from B to A = 0.1(Processing delay) + 0.0005(Propagation time) = 1.005

The whole time to send 3 packets and the acknowledgements = 1.54 + 0.1005 = 1.6405

Utilization = the actual time spent sending data is 1.54 but the whole process took 1.6405

So, 1.54 / 1.6405 = 0.9387 therefore, utilization is %93,87