	<b>Module Code</b> <b>13CSCN01I</b> <b>Final Examination,</b> <b>2014-2015</b>	
Module Title: Introduction to Computer Networks and Communications		
Module Leader: Dr. Amal ElNahas		Semester <b>One</b>
Equipment allowed (for example calculator – dictionaries)	Calculators	

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### Instructions to Students

- *You should attempt all questions*
- *The exam paper is 3 pages long, and is in 1 section.*
- *The approximate allocation of marks is shown in brackets by the questions.*

This examination is   2   hours long.

**Q 1** Security at a nuclear plant consists of a set of checkpoints separated by 200m. Workers line up at the entrance of the plant and enter one by one. At each checkpoint, workers present their ID card to the security officer. The officer reads the card and asks the workers a few questions. Afterwards, the officer writes down this information and asks the worker to pass through a metal detector. The worker then walks to the second checkpoint. Identify what is equivalent to **processing** delay, **propagation** delay, **queuing** delay, and **transmission** delay in this problem.

**[Total: 8 marks]**

**Solution:**

- Processing delay: worker presenting his/her ID and the officer asking him/her a few questions and writing down information.
- Propagation delay: worker walking from one checkpoint to the other (100m distance).
- Queuing delay: time spent by each worker in line at the entrance.
- Transmission delay: time taken by the worker to pass through the metal detector

**Q 2** Consider a user on machine A requesting a web page containing 6 objects from server S that is on a different network. If 4 of the 6 objects reside on machine K that is on another different network, the RTT between A and S is 100 msec, the RTT between A and K is 150 msec, the RTT for any DNS query is 10 msec. Assume iterative DNS queries and http/1.1, calculate the total time needed to display the web page.

**[Total: 14 marks]**

**Solution:**

Time needed = DNS query time + 1 RTT<sub>s</sub> (to open connection) + 1 RTT<sub>s</sub> (get base file) + 2 RTT<sub>s</sub> (to get 2 objects from S) + 1 RTT<sub>K</sub> (to open connection with K) + 4 RTT<sub>K</sub> (to get 4 objects) + total file transmission time.

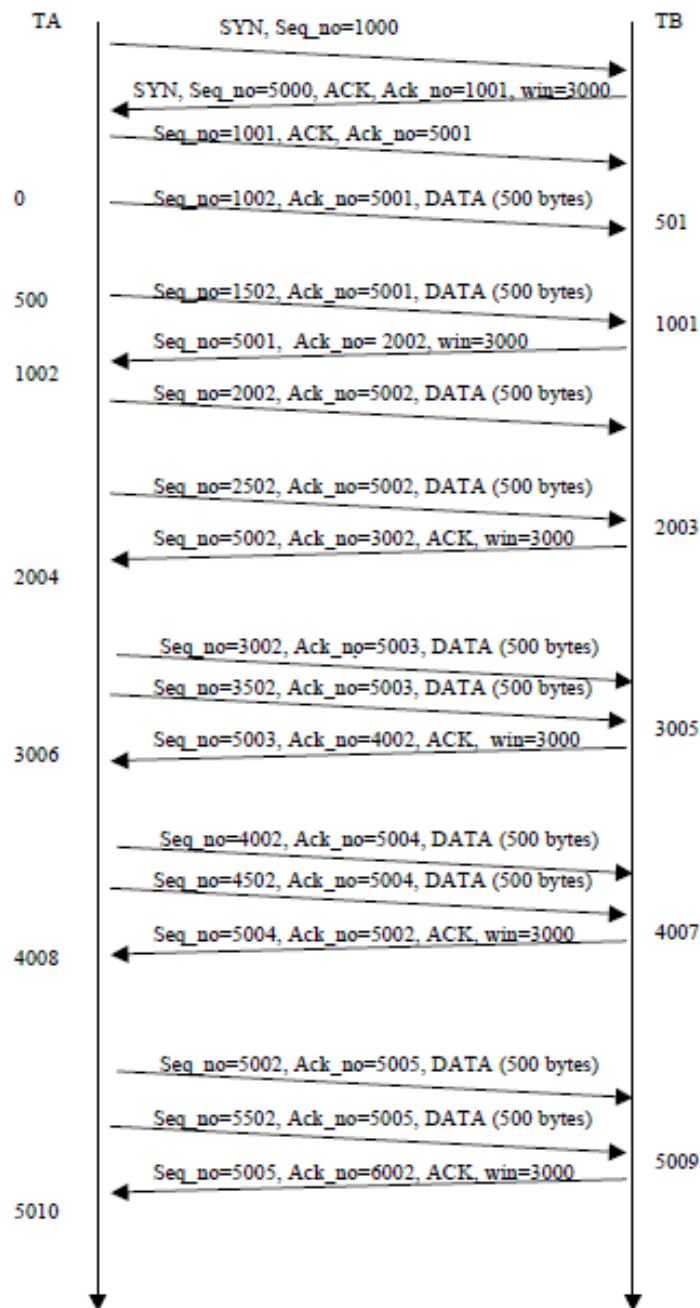
Time needed =  $8 \times 10$  **(4 marks)** +  $4 \times 100$  **(4 marks)** +  $5 \times 150$  **(4 marks)** + files transmission time **(2 mark)**

Time needed = 1.23 sec + file transmission time.

- Q 3** The TCP in station A sends a SYN segment with ISN = 1000 and MSS = 1000 to station B. Station B replies with a SYN segment with ISN = 5000 and MSS = 500. Suppose station A has 5,000 bytes to transfer to B. Assume the link between stations A and B is 8 Mbps and the distance between them is 200m. Neglect the header overheads to keep the arithmetic simple. Station B has 3000 bytes of buffer available to receive data from A. Sketch the sequence of segment exchanges if station A sends its first data segment at  $t = 0$ . Station B has no data to send and sends an ACK segment every other frame.

**[Total: 16 marks]**

**Solution:**



**Q 4** An organization has been assigned the network address: 140.25.0.0, and it needs to create a set of subnets that support up to 25 hosts on each subnet.

i. What is the subnet mask you would use to do this?

**[4 marks]**

- ii. What is the maximum possible number of such subnets in the given network?

[4 marks]

- iii. What is the broadcast address for each of the subnets?

[4 marks]

- iv. Given that there are 25 hosts on each subnet, how much of the address space is being wasted (in percentages)?

[4 marks]

[Total: 16 marks]

**Solution:**

- i. Address 140.25.0.0 is class B address  $\Rightarrow$  available bits in hostID part = 16.

Required No. of hosts = 25  $\Rightarrow$  required No. of bits in new hostID = 5 and  
required No. of bits in subnet ID = 11

Thus, the subnet mask: 255.255.255.224, or

11111111 11111111 11111111 11100000

- ii. Maximum number of subnets =  $2^{11} = 2048$

- iii. Broadcast address is 255.255.255.224

- iv. Instead of  $2^5 - 2 = 30$  hosts, each subnet uses only 25 hosts.

So, in each subnet, 5 addresses are not used.

Wastage =  $5/30 = 1/6 = 16.67\%$

**Q 5** An IP datagram carrying 10000 bytes of data must be sent over a link that has an MTU of 4468 bytes. Assume the datagram has no Options, and the Identification number is 218.

- i. How many fragments will be generated?

[3 marks]

- ii. State the values (in decimal numbers) of the following fields for each of the fragments:

**Identification, Total Length, D-bit, M-bit, Fragmentation Offset**

**[17 marks]**

**[Total: 20 marks]**

**Solution:**

- i. 3 fragments: 1st fragment : 4448 +20 bytes, 2nd fragment:  
4448 +20 bytes, 3rd fragment: 1104 +20 bytes

ii.

	First	Second	Third
Identification	218	218	218
Total Length	4468	4468	1124
DF	0	0	0
MF	1	1	0
Offset	0	556	1112

**Q 6** Perform CIDR aggregation on the following /24 IP addresses:

128.56.24.0/24; 128.56.25.0/24; 128.56.26.0/24; 128.56.27.0/24. What will be the new mask value?

**[Total: 10 marks]**

**Solution:**

128.56.24.0/22 = 10000000.00111000.00011000.00000000

128.56.25.0/22 = 10000000.00111000.00011001.00000000

128.56.26.0/22 = 10000000.00111000.00011010.00000000

128.56.27.0/22 = 10000000.00111000.00011011.00000000

mask = 11111111.11111111.11111100.00000000

**Q7** Draw the signal encodings of the given bit-stream : 10111001, for the encoding schemes NRZ-I and NRZ-L

**[16 marks]**

**Solution:**

