University of Glasgow

DayOfWeek DayOfMonth Month 2XXX
XX.XX am/pm – XX.XX am/pm
(Duration: 1 hours 30 minutes)

DEGREES of MSci, MEng, BEng, BSc, MA and MA (Social Sciences)

Networks and Operating Systems Essentials 2

Answer All Questions

This examination paper is worth a total of 60 marks

The use of a calculator is not permitted in this examination

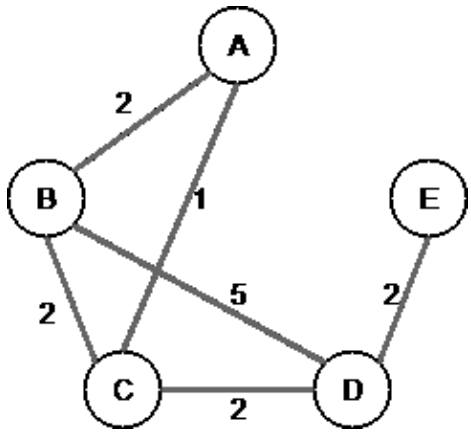
INSTRUCTIONS TO INVIGILATORS

Please collect all exam question papers and exam answer scripts and retain for school to collect. Candidates must not remove exam question papers.

1. The lower three layers of the OSI reference model operate in a hop-by-hop manner, while the upper four layers operate end-to-end. With references to the roles of the different layers, explain what is meant by this, and why the distinction arises.

[9 marks]

2. Consider the network graph pictured below. Nodes represent devices on the network, edges represent links and the numbers by the edges represent the cost of forwarding a message across that link. Assume that the network is using a Distance Vector protocol, that all message exchanges happen at the beginning of every round of the protocol, and that hosts update their state after they've received all messages destined to them in the current round. Show the initial routing state of all nodes in the network, and their routing state after every round of the protocol. In your answer please show the routing table entries (distance/next hop) of all nodes in the network (i.e., a 5 x 5 matrix), for each iteration of the algorithm. Your answer should include 3 such matrices, including the one for the original state (i.e., nodes only know of themselves and their 1-hop neighbours).



[12 marks]

3. The two most widely used transport protocols in the Internet are TCP and UDP. Describe the service models provided by these two protocols, being sure to highlight their main differences.

[8 marks]

4. The DNS has been described by some an essential component of the Internet, that is required for its correct operation. Others claim that it's just one application out of the many that run on the Internet. Which viewpoint is correct? Discuss.

[5 marks]

5. Describe the benefits that come from using network address translation in an IPv4-based network.

[3 marks]

6. Consider a cache with 3 slots and the following stream of requests:

A, B, D, C, A, B, B, C, D, A, A

Give the contents of the cache after each request and indicate cache misses if the cache is using (i) the LRU algorithm and (ii) the LFU algorithm.

[8 marks]

7. Explain what an offset is and calculate how many bits of offset will be needed for a 6K page.

[3 marks]

8. Consider the following set of processes, with the length of the CPU burst given in milliseconds:

Process ID	Burst Time	Priority
P1	4	3
P2	1	1
P3	7	4
P4	5	3

Assume that processes have arrived in the order P1, P2, P3, P4, all at time 0.

Show the scheduling order and execution times of individual process, and compute the turnaround time of each process and the average waiting time over all processes, for each of the following scheduling algorithms: FCFS, SJF, non-preemptive priority (a smaller priority number implies a higher priority), and pre-emptive RR (quantum = 3).

[12 marks]