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

University of Glasgow

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**

1. Identify and briefly describe the key functions of any three layers in the OSI reference model. Name an exemplar protocol in each layer; expand any acronyms in your answer.

[6 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 (note: in the lecture example, these weights were assumed to all be 1). 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 1 such matrix per iteration of the algorithm, including the one for the original state (i.e., nodes only know of themselves and their 1-hop neighbours).
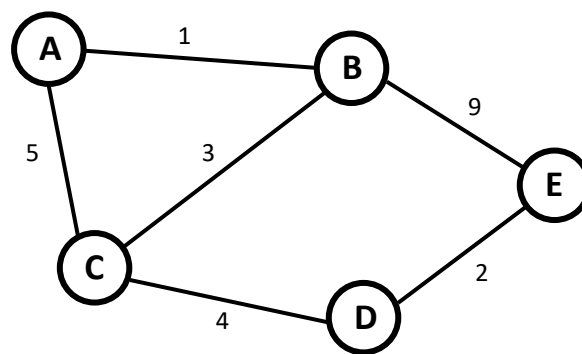
[12 marks]

3. You are implementing an interactive video conferencing application, to run over an IP-based network. You can implement this application using either TCP or UDP at the transport layer. Which of these two transport layer protocols would you choose? Discuss the advantages and disadvantages of the two approaches and outline any cases where the other transport layer protocol would be more appropriate.

[12 marks]

4. Many applications use the Domain Name System (DNS) to map between host names and IP addresses. Imagine some catastrophic failure happened, so that the DNS root name servers all failed simultaneously and stopped answering queries. Discuss how the effects of such a total DNS failure would manifest themselves, and how quickly they would become visible.

[5 marks]

5. Network Address Translation (NAT) devices are widely used in the Internet. Describe the purpose of a NAT and give four reasons why NAT devices are used in the Internet.

    [5 marks]

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

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

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

Process ID	Burst Time	Priority
P1	6	3
P2	2	2
P3	7	4
P4	4	4

    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-pre-emptive priority (a smaller priority number implies a higher priority), and pre-emptive RR (quantum = 3).

    [12 marks]