The University of Melbourne
School of Computing and Information Systems

COMP90007, Internet Technologies Final Exam

Semester 1, 2020

- This examination is worth of 65% of your final mark. It is a 3 hour exam.
- There are 15 questions in the exam and a total of 6 pages including this cover page.
- You may access other materials during the exam. Advise on accessing materials for the exam: You only need a text editor to answer this exam's questions. No other materials are really needed. Calculators should not be needed as questions require simple calculations to answer. Referring to the book or other resources throughout this exam should not be of much help for this exam if you understood the contents of the subject and studied properly for the exam, and rather you may see that if you spend a lot of time looking through the pages of our book, you may be losing a lot of time that you could have used answering questions properly.
- Attempt all questions, partial marks will be available. No question requires writing lengthy answers. Please be clear and brief as you may lose points for unclear or redundant descriptions.
- The values in square brackets after questions show the marks allocated to each question.
- You are welcome to use the text editor of your choice to edit the answers. You do not need to repeat the questions in your answers. Just make sure you use the right question number per answer. Type your answers: No handwritten answers.
- Start your answer document with writing your student ID on top of your document, e.g., "Student ID: …". Then please mention "COMP90007 Final Exam Answers" in the next line. Then go to the next next line and start with your answers as: "Question 1 Answer: …" and so on.
- Please answer questions in the given order and separate the answers with a few blank lines to give some space between the answers to different questions.
- Make sure to save your progress locally during the exam and at the end a **PDF version** of your file too. Upload only that PDF version when you are finished. We recommend not leaving the uploading of your PDF version to the last minute.

Question 1: [6 Marks]

For each of the layers of the OSI model state one key functionality that layer brings to networking; use one sentence explaining each. Then briefly explain what would be the problem(s) emerging if we were to combine the bottom two layers into one layer.

Question 2: [3 Marks]

A computer is connected to an Internet Service Provider with a modem having 256Kbps connection capability. Given a frame size of 128 bits, compute the latency of communication for this computer to the provider's server that the computer connects to. You can assume that the connection uses a fiber link, and speed of light for that particular medium is 100,000km/s. Also assume that the connection is only 1km long. Compute the latency under these settings. Show your calculations.

Question 3: [4 Marks]

We have seen the MAC sublayer in class. Compare wireless communication mediums with respect to classical wired mediums and state the new issues we face using a few sentences to explain each issue.

Question 4: [6 Marks]

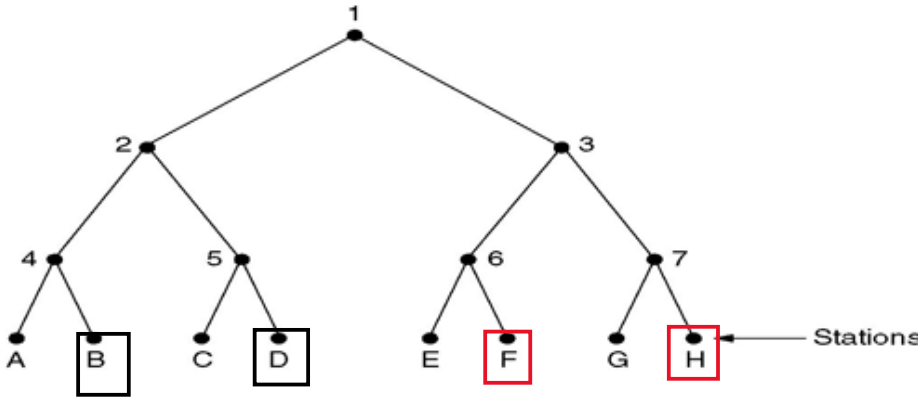
We need to use the Cyclic redundancy check method for some data transmission as a means to deal with errors. Please compute the final data to be sent given the following information and show your steps/calculations. Original Data is 10010100 and your G(x) is $x^4 + x + 1$. [*Important Note*: When showing your calculations you can use the following notation, but also note that the numbers given in the notation example below have nothing to do with the question above and the operations there should not be taken as an indication how your solution would be. This sample is there simply to give you an example means that you can use to easily enter your solution with your editor while avoiding complicated drawings/diagrams.]

Question 5: [5 Marks]

A channel has a bit rate of 15kbps and a propagation delay of 20ms. For what value of frame size does stop-and-wait protocol give an efficiency of 25 percent? Show your calculations.

Question 6: [4 Marks]

Given the adaptive tree walk protocol we have seen in class what happens with the following organization of stations and only B, D, F, and H want to send something. Please give steps in time, one per line, and explain briefly what happens in each time step.

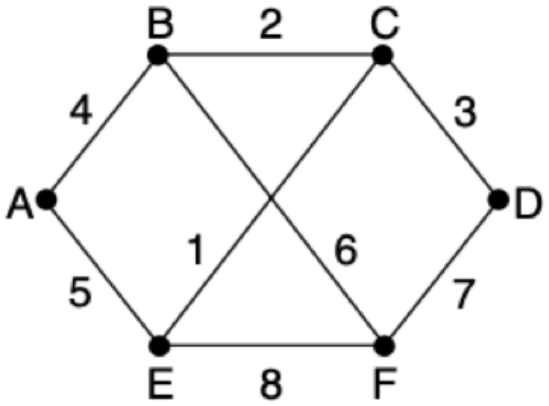


Question 7: [6 Marks]

Distance vector routing is used for the six nodes given below, connected as shown in the figure. The following vectors have just come into router C from B: (5, 0, 7, 11, 10, 7); from D: (15, 11, 4, 0, 10, 11); and from E: (5, 10, 6, 10, 0, 3). Each vector contains the distances from a certain node to the other nodes, in the order of (A, B, C, D, E, F). The distances from C to B, D, and E, are 7, 4, and 6, respectively. What is the new vector for C: Use a list of outgoing lines to use and the expected distances from C to the other nodes, one entry per line for this would be clear enough and there is no need to draw a figure.

Question 8: [5 Marks]

Please first briefly explain in a few steps how Dijkstra's algorithm works for this question as we saw in class. Then given that Dijkstra's algorithm, compute the shortest path from C to F for routing data for the following simple network. You do not need to show your steps but just give the final path.



Question 9: [5 Marks]

For the transport layer, we want to use symmetric connection release. Is there a way to develop a perfect protocol for this, i.e. that does not lose any data in connection release regardless of circumstances? If the answer is yes, then explain one such protocol with a few sentences using two connected hosts and give the key insight of your solution as well. If not, then explain with a few sentences why it cannot be developed by discussing/modeling the problem at a higher level.

Question 10: [3 Marks]

How does transparent fragmentation in Network Layer works, explain with a few sentences and mention its benefits and disadvantages.

Question 11: [3 Marks]

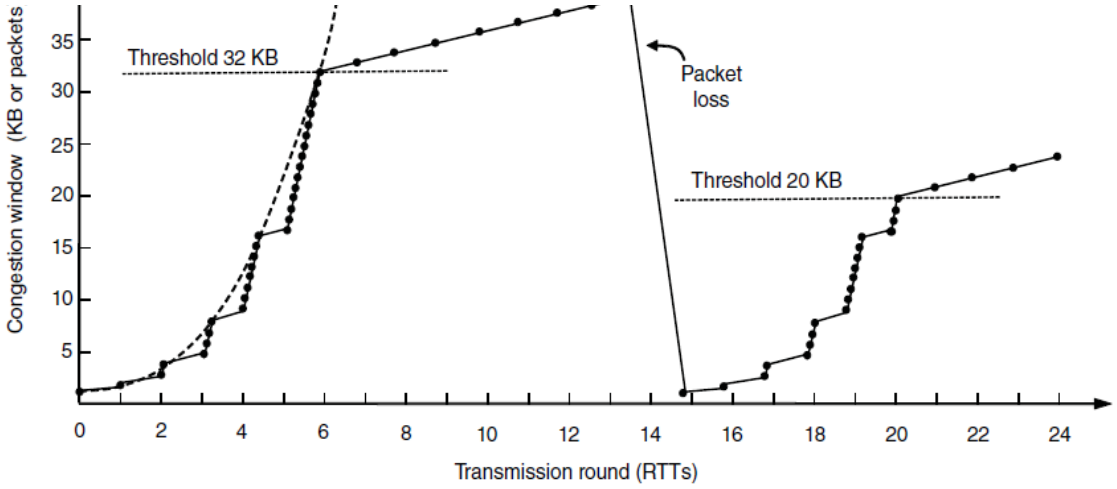
Briefly explain the difference between flow control and congestion control in networking.

Question 12: [3 Marks]

A Hamming distance of 3 is given for a particular coding mechanism with a given alphabet of codewords of 000000, 000111, 111000, 111111, e.g., 01 becomes 000111. How many bit errors can this scheme correct? Show your calculations and briefly explain.

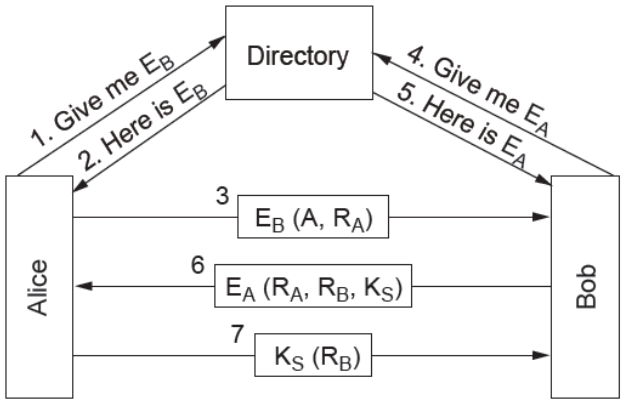
Question 13: [4 Marks]

Given the following figure for analysis of what TCP Tahoe does for congestion control that we saw in class, explain what happens in transmission rounds 0 – 6 and 15 - 20 briefly, describing the algorithms used there. Then describe how we can improve upon that.



Question 14: [5 Marks]

Given the following protocol for authentication using Public Key Cryptography we saw in class, if we change the steps as stated in this question and then try to use the protocol, i.e., instead of the original steps that are given in the following figure, what would happen to the algorithm/communication, what would be changing in the protocol and how? Briefly explain. Changes are: Step 3: R_A is dropped as well as Step 6: K_S is dropped and Step 7: K_S is replaced by E_B.



Question 15: [3 Marks]

I can create a simple cipher as follows: i) create a random bit string as a key for this transmission only on my computer ii) convert my plaintext that I want to send by using its ASCII representation to a bit string as well iii) compute the XOR of these two strings bit by bit (assuming the same length for the two strings for the sake of simplicity for this question) iv) send the result string across to the other host who can undo the XOR operation. Is there a way to break this method, e.g., an intruder understanding this message somehow? If yes, give a way to break it, if not state the key reason why it cannot be broken. Then, briefly discuss the main strengths and weaknesses of this method.

…END OF EXAM