INST346 Final Exam Fall 2017

You have 120 minutes to complete this exam. Time begins promptly at 4:00 PM and ends promptly at 6:00 PM. You may not read the exam questions before 4:00 PM.

Please record your answers in a Word file or a text file (or in some other file type that you can easily convert to PDF). Submit that file on ELMS and also email it to both oard@umd.edu and rashmi@umd.edu. Make sure your name is in the file!

You may use any information and software that existed before the start of this exam. This means (among other things) that you may search the Web.

You may NOT communicate with any other person other than the professor and the teaching assistant (Rashmi) for any purpose during the exam period, either in person or in any other way, and you may not post anything to any location other than ELMS (to submit your exam) for any purpose during the exam period. Note that this means you may not have skype, email or any instant messaging application active on any device that you use during the exam, and that that even if you leave the exam room early you may not talk with anyone about anything, you may not send or receive any email, etc. until the exam period ends at 6:00 PM.

You may not use headphones during this exam except when listening to a class video (if you choose to do so during the exam).

Hand type – no cut and paste – the honor pledge followed by your name as your signature on this exam. (For reference, the honor pledge as stated at http://osc.umd.edu/Uploads/OSC/Honor%20Pledge.pdf, is: "I pledge on my honor that I have not given or received any unauthorized assistance on this exam.")

As strategies for completing the exam, keep the following in mind:

- If you find a question to be ambiguous, you may come to the front of the room to ask about it, but please do so in a way that other students can't hear. If you don't get an answer that resolves your question, then please explain your confusion and any reasonable assumptions that you have made in order to answer the question and include those with your answer so that they can be considered during grading.
- You are more likely to get partial credit for an incorrect answer if you show your work.
- **Be careful not to spend too much time on any one question.** The total available credit on this exam is 25 points. Plan ahead, and don't devote more time to a question than it is worth.

***** WRITE YOUR NAME! *****

Answer **all six** of the questions on this exam:

1. [10 points total; 2 points for each part] Consider the case of a SSL connection between your Web browser and a Web server in Australia with the URL https://www.rmit.edu.au/. Answer **all five parts** (a through e) of this question:

   a) [2 points] Explain the process by which the routing tables are set up in each router so that your packets can get from your computer to the server in Australia. For full credit you need to not just name the protocols and algorithms, but also to describe how they work together to construct a complete set of routing tables.

   b) [2 points] Explain what information your Internet Service Provider (which in this case is the University of Maryland's campus computer network) would be able to detect about your interaction with that server? Would they know that you used HTTP? Would they know what the content of the Web page you looked at was? Would they know when you received the Web page? These are just examples of the sorts of things you should think about. List **everything** that they would be able to know (without trying to decrypt any encrypted content). Note that this is not a question about policy, it is a technical question about what they could know about your interaction with the server in Australia.

   c) [2 points] Your Web page will need to go through many routers to get from Australia to College Park, and some of those routers may delay or drop packets. TCP will retransmit any packet that is not acknowledged before some timeout limit is reached. Explain how that timeout value is set.

   d) [2 points] Use your knowledge of sources of delays in networks to provide a reasonable estimate of what timeout value would typically be used for the TCP connection between College Park and Australia. State your answer in seconds, milliseconds, or microseconds (specify which you are using) and explain how you estimated that number. You will get no credit for just listing a number, even if you get that number from traceroute; you must explain how you used your knowledge of sources of delays in networks to estimate that number.

   e) [2 points] Assume that the server in Australia reaches the Internet through a switched Ethernet network. Would your computer need to know the Ethernet MAC address of the server in Australia to get its packets there? If so, how would your computer learn that MAC address?

2. [4 points] In the United States, it is legal for your Internet Service Provider to monitor your network traffic and to sell information about your online activities that it learns to advertisers, credit bureaus, and the police, all without your consent. Provide two different strong arguments against this practice, and then provide two different strong arguments in favor of this practice.

3. [5 points] Answer **one** of the two parts of this question. If you answer both parts, only the first will be graded.

    a. Explain how edge caching could be used together with drones and delay tolerant networking to provide some type of Internet access to researchers in the Amazon rainforest. Then explain how the services you could provide would differ from what you could provide for links between Earth and Mars, and explain the reasons for those differences.

    b. You have been hired as a consultant to help a new startup company get its product more widely adopted. This new company makes a free app for Android and iPhone smartphones that allows you to communicate anonymously with random people who have experienced something that you have just experienced. For example, if you go bungee jumping in Queenstown New Zealand on Spring Break, it can connect you to other people who did the same thing at Spring Break last year. In this way, the new app creates a social network around personal experiences. Explain how the company can take advantage of what we know about how new ideas get adopted to increase the rapidity with which their app gets adopted. To receive credit, your answer must say more than that you will help them advertise their product in traditional ways. Rather, you must explain the process of adoption, and how the company can influence that process.

4. [2 points] Consider the process of using WiFi (802.11) wireless networking when radio signals from your computer can reach two different Wireless Access Points equally well. Explain how your computer decides which one to route packets through. To receive credit for your answer, you need to do more than name the protocol that is used – you need to explain how it works.

5. [2 points] Explain what is done by the transport layer if a UDP packet's checksum is determined to be incorrect when the packet is received.

6. [2 points] Describe at least two technical characteristics of the physical layer for 4G cellular data plans that differ from the technical characteristics of the physical layer for WiFi (802.11) wireless networking. A complete answer to this question will list technical characteristics of 4G and 802.11 wireless networking in a manner that facilitates easy comparison (e.g., as sentences comparing specific characteristics, or as a table).

*** WRITE AND SIGN THE HONOR PLEDGE ***