

You have 50 minutes to complete this exam. Time begins promptly at 1:00 PM and ends promptly 50 minutes later. You may not read the exam questions before 1:00 PM, but you may read these instructions.

Please record your answers in a Word file, in a text file, or on a piece of paper (which could be this printed exam or any other paper). You can answer some questions one way (e.g., as Word) and others the other way (e.g., by writing on paper). At the top of every piece of paper or every file in which you write an answer, write your name and the date. If you answer any questions using Word or a text file, submit that file on ELMS and also email it to both oard@umd.edu and mwalker1380@gmail.com. If you answer any questions on paper, turn in that paper. Make sure your name is on everything that you turn in! And if you use both paper and a file, make a note on each about what can be found in the other so that we don't miss any of your answers.

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 for any purpose during the exam period, either in person or in any other way, and you may not post anything to any location 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 1:50 PM.

Hand write and sign (or, if you type your answers, hand type it – no cut and paste – followed by your name) the honor pledge on this exam. (For reference, the honor pledge as stated at <http://shc.umd.edu/SHC/HonorPledgeUse.aspx>, 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, please explain your confusion and any reasonable assumptions that you have made in order to answer the question, and include that explanation and those assumptions with your answer so that they can be considered during grading. The teaching assistant (Mike) can answer questions about these instructions, but he can not answer questions about the content of the exam.
- 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 20 points. Plan ahead, and don't devote more time to a question than it is worth.

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

Answer any four of the following six questions (if you answer more than four, we will grade only the lowest numbered four that you answer):

1. [5 points] Consider the case of a computer with a one terabyte (TB) hard disk drive with 512 byte sectors that has a 10 millisecond average access time (which means that is able to transfer a different 512 byte sector from disk into main memory every 10 milliseconds). If there is a single 100 megabyte file in which the sectors are placed at random locations on the disk, how long would it take to read that file into RAM (i.e., into the computer's main memory)?
2. [5 points] Answer BOTH parts of this question:
 - a. [3 points] Compute the number of bytes necessary to represent a photograph that is stored as a 1024 dot wide by 768 dot high image file in which each dot is represented as one of 256 values each for the colors red, green, and blue.
 - b. [2 points] If a good lossy compression scheme such as JPEG (i.e., .jpg) is used to compress the resulting file (while maintaining a fairly good picture quality), approximately how many bytes of disk storage would you expect the compressed picture to require? Your answer to this question does not need to be exact – a rough estimate is all that is needed. But your rough estimate should be realistic!
3. Answer BOTH parts of this question:
 - a. [3 points] Describe a two-factor authentication system that is designed to reduce the probability that an unauthorized person would be able to gain access to a computer account.
 - b. [2 points] Describe a realistic situation in which an unauthorized person would be able to gain access to the computer account despite the use of the specific two-factor authentication system that you described in part a.
4. [5 points] Explain why public key encryption (rather than symmetric key encryption) is used to implement digital signatures.
5. [5 points] Both RAID-5 and tape backup can help to avoid loss of data in the event of a hard disk drive failure. Explain ONE reason why RAID-5 is better than tape backup. Then explain ONE reason why tape backup is better than RAID-5.
6. [5 points] Explain how specific components of a smartphone could be used by an app to determine where the phone is located (in the world) and how it is oriented (e.g., laid flat on a table with the top pointed east, or held vertically in your hand with the back facing northwest). Then explain which smartphone components could be used by an app to detect changes in the orientation of the phone.

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