

# COMPUTER SCIENCE E-1

*Understanding Computers & the Internet*

## PROBLEM SET 2

**Due Monday, February 11 at 5:30pm**

**Out of 43 points**

### **Academic Honesty**

All work that you do toward fulfillment of this course's expectations must be your own unless collaboration is explicitly allowed by the staff. Viewing, requesting, or copying another individual's work or lifting material from a book, magazine, website, or other source—even in part—and presenting it as your own constitutes academic dishonesty, as does showing or giving your work, even in part, to another student.

Similarly is dual submission academic dishonesty: you may not submit the same or similar work to this course that you have submitted or will submit to another. Nor may you provide or make available solutions to homework or exams to individuals who take or may take this course in the future. Moreover, submission of any work that you intend to use outside of the course (e.g., for a job) must be approved by the staff.

If in doubt as to the appropriateness of some act, contact the staff. All forms of academic dishonesty are dealt with harshly.

### **Submission Instructions**

To submit this problem set, head to E-1 Submit (<http://cse1.net/submit>), where you can upload a PDF, Word Document, or Rich Text File. PDF files are preferred.

## Dinkleberg!

1. (3 points) You know that neighbor who always one-ups you? Apparently, he just bought a processor that has twice as many cores as yours. Why is that better? What effects does a higher number of cores have on performance? Is your neighbor's processor twice as fast because it has twice as many cores?
2. (2 points) Unsatisfied, your neighbor turns in his processor for a new CPU whose clock speed doubles that of your CPU. Now, is it twice as fast? Why or why not?

## A Parallel Universe

3. (2 points) What does it mean for a CPU to be superscalar? Why does a superscalar architecture improve the efficiency of a CPU?
4. (2 points) If Moore's Law says processing power will double every 18 months, then why can't our processors have phenomenal cosmic power? (<http://www.youtube.com/watch?v=SfTfXLLJlzM>) That is, why can't this trend continue forever?
5. (5 points) It's Halloween again, and you and 7 of your closest friends have a huge bag of candy. Now, you'd like to figure out how many different types of candy (e.g., Milky Way, Snickers, or Krackel) you received on your travels. To be clear, if you only got 4 Milky Way bars and 3 Snickers bars (sounds like you need a new trick-or-treating strategy), then you would have 2 different types of candy. Without your friends, how could you solve this problem? Now, propose a different way of solving this problem that allows you to count the candy faster using your friends' help. Why is your new method that takes advantage of all 8 people faster? If helpful, you and all of your friends are in the same room (so they can talk to each other), and that room is stocked with paper and pencils if you need to write anything down. Try to think of the fastest solution possible!

## Photographic Memory

6. (4 points) My good friend is a budding photographer wondering what size memory card she should buy. Her new camera can use either a CompactFlash card (also called a CF card for short) or a Secure Digital card (also called an SD card for short). Give her a sense of what her options are! For at least two different memory cards sold at the store of your choice (e.g., BestBuy, Amazon, or Fry's), tell her:
  - i. How large the card is in GB
  - ii. What the card costs
  - iii. About how many photos the card can store
  - iv. Whether or not you think she should buy the card
7. (2 points) My father has a huge music collection, so he's probably going to want to buy a computer with a lot of RAM, right? Why or why not?

## Cache Money

8. (2 points) Let's say you purchased a computer that (for some reason or another) didn't have an L1 cache, L2 cache, or L3 cache. Is it possible that such a computer could even function? Why or why not?
9. (2 points) If registers and the processor cache are faster than RAM, why do computers use RAM for short-term memory storage?

## Storage Wars

10. (3 points) My computer has an HDD, and I just opened a Word document. In a succinct but technically detailed paragraph, how is that data read from the HDD?
11. (2 points) Why would you ever want to purchase an HDD over an SSD? How about an SSD over an HDD?

## Matching

12. (6 points) Match each item in the left-hand column with the most appropriate descriptor in the right-hand column. For each item, only one descriptor is most appropriate, so you should use each descriptor exactly once!

a. RAM	i. 32 bits
b. HDD	ii. 64 KB
c. L1 cache	iii. 2.6 GHz
d. Register	iv. 500 GB
e. L2 cache	v. 4 GB
f. CPU	vi. 4 MB

## Bargain Hunter

13. (8 points) Congratulations! You've just won the E-1 lottery, which has a prize of 1400 virtual dollars! You can claim your prize on one condition: you can only spend your winnings on a new computer. First, check out Ben's section video on shopping for laptop and desktop computers, where he discusses the advantages and disadvantages of both. Now, it's your turn to purchase yourself a brand new computer. Head to your local computer store to get a sense of your options, and feel free to ask questions of the store's employees! (You probably don't want to tell them that your lottery winnings are virtual, though). If you can't make it to a computer store, then you're free to do your shopping online, but you're highly encouraged to shop for a computer in person!

Now, tell us about your experience in two or more paragraphs below. What computer would you ultimately decide to purchase? Why? If you interacted with any of the store's employees, what happened? Tell us about your "new" computer's specifications, namely:

- i. Brand and model
- ii. Price
- iii. Hard drive capacity
- iv. Hard drive type (HDD or SSD)
- v. Amount of RAM
- vi. Model and speed of CPU
- vii. CPU cache size
- viii. Display size and maximum resolution
- ix. Operating system