**Max Score = 15 points**

CS 250 2018 Spring Homework 10

This assignment is due at 11:59:00 pm Thursday, April 19, 2018.

Insert your typewritten answers into this file. You may include images of neatly hand drawn diagrams when appropriate. To have this assignment graded, upload your file to Blackboard in either PDF or Word format. You may upload more than once to permit correction of errors. Late submissions will receive a score of zero (0).

You are responsible for ensuring that your upload (1) is to the location in Blackboard for this assignment, and (2) is the file that you intend to have graded for this assignment, and (3) is not marked “LATE” by Blackboard. You are encouraged to verify your upload was successful by downloading your file from Blackboard and examining that download.

Please be aware that Blackboard determines if an upload is late using an internal timer that measures time in units of seconds, but reports time to its users rounded down to the minute. This means that one second after Blackboard first shows time as 11:59pm any completing upload will be marked LATE because the internal program time is then after 11:59:00pm. Upload sufficiently before the stated deadline to avoid being late due to an upload that completes after 11:59:00pm.

1. Text exercise 18.2

If a computer has four cores plus two GPU cores, does the system have symmetric parallelism, asymmetric parallelism, or some of both? Explain? **The system has asymmetric parallelism. This is because CPU and GPU can operate simultaneously, but differ internally.**

1. Text exercise 18.5

A C programmer is writing code that will run on multiple cores, and must increment a shared variable x. Instead of writing: x = x + 1; the C programmer writes: x++; Does the second form guarantee that two cores can execute the increment without interfering with one another? Explain. **The second form does guarantee that they won’t interfere because the second one modifies and returns a copy of the old x. Whereas the first one just returns the value of the expression and does not modify the x.**

1. Go to top500.org. Purdue University faculty members pool their research funds each year to buy a single large cluster computer to be operated as a condominium with AirBnB-like management. This approach allows Purdue researchers to own 100% of some of the world’s fastest computers. Twice each year top500.org ranks the fastest computers in the world. Find the Purdue computers in the most recent Top500 List for November 2017 (a new list will come out in June). For the #1 ranked computer and all ranked Purdue computers, list the machine name, current ranking, # cores, core clock speed, and interconnection fabric. (Machine details are given at links by clicking on the machine name in the ranking table.)

**Sunway TaihuLight - #1 - 10,649,600 cores – 1.45 GHz – Sunway**

**Conte - #190 – 77,520 cores – 2.600 GHz – Infiniband FDR**

**Brown - #302 – 12,960 cores – 2.6 GHz – Infiniband EDR**

1. Text exercise 19.3

An engineer builds a data pipeline with eight processors. To measure performance, the engineer runs the software on one processor and measures the time taken to process a single data item. The engineer then divides the software into eight stages, and measures the time taken to process a single data item. What do the measurements show? **They are measuring the performance on one processor and then measuring the performance between all 8 processors to see if they all process at the same speed.**

1. Text exercise 19.6

You are given a program that runs on one core, and are asked to divide the program into pieces that will use up to eight cores in a data pipeline. You can divide the program two ways. In one, the cores each perform 680, 2000, 1300, 1400, 800, 1900, 1200, and 200 instructions. In the other, the cores perform 680, 1400, 1300, 1400, 1400, 1000, 1200, and 1100 instructions. Which division do you choose, and why? **I would choose the second division because it more evenly divides the work of the cores. This makes it so that the cores work evenly and that one core is not working harder than the rest.**

1. Text exercise 20.2, except 20% reduction.

Suppose the frequency of a clock is reduced by 10% and all other parameters remain the same. How much is the power reduced?

**Pavg = 100\*.8 = 80**

**So the power is reduced by 20% if the frequency is reduced by 20%.**

1. Text exercise 20.3, except 20% reduction.  
   Suppose the voltage, Vdd , is reduced by 10% and all other parameters remain the same. How much is the power reduced?

**Pavg = 100\*.8 = 80**

**So the power is reduced by 20% if the voltage is reduced by 20%.**