

CS2810 Homework 2 – 50 points - Due by midnight September 13. Submit this homework through Eagle.

For this homework assignment you may work individually or in a group of up to 3 students. If working in a group, be sure that when you turn in your homework through Eagle you include the names of everyone in the group.

Questions 1-3: (Fill in the blank) 1 point each

- 1.) The essence of computer science is _____
- 2.) The science of computer science is _____
- 3.) The challenge of computer science is the _____

Questions 4-6: 4 points each

- 4.) In decimal (exactly), if a computer has a 32-bit address for every byte in memory, how many memory locations can this computer address?
- 5.) In decimal (exactly), if one does an exhaustive search of all possible paths in a traveling salesperson problem with 29 cities to visit, how many individual paths will there be? Assume that each path is a circle, i.e. after visiting all cities, the salesperson makes one final trip back to her/his start city.
- 6.) Assume that you are evaluating all of the transits or paths of problem (5), and you have a computer defined as follows:

Single core
Clock speed is 4 GHz
Evaluating a single transit requires 128 clock cycles

How many seconds will it take to evaluate all of the transits of problem 5?

Questions 7-11: 2 points each

- 7.) (True/False) If I examine a program in terms of its machine (binary) language instructions and the logic gates needed to execute those instructions, I am examining that program from a computer organization perspective.
- 8.) If it costs \$1,000,000 to build a chip manufacturing plant today, how much would you expect it to cost to build a chip manufacturing plant in 2021?
- 9.) (True/False) Increasing the size of an integrated circuit die will increase the chip yield rate.
- 10.) (True/False) The machine level of a computer is also known as the assembly language level.
- 11.) (True/False) The HIV virus' diameter is greater than the current wire width for Intel's core duo chips.

Questions 12-16: 5 points each

- 12.) Let's say I have a program consisting of 100,000 instructions. In building a new computer I discover that 25% of those instructions actually run twice as fast in the new machine as in the old machine. The other 75% of the instructions run at the same speed

on both computers. If the old computer took 10 seconds to execute this program, how long will the new computer take to execute the program.

- 13.) Let's say my favorite computer program runs in 10 seconds on computer A, which has a 2 Ghz. clock. We are trying to help a computer designer build a new machine B, that will run this program in 5 seconds. The designer can use new (or perhaps more expensive) technology to substantially increase the clock rate, but has informed us that this increase will affect the rest of the CPU design, causing machine B to require 1.25 times as many clock cycles as machine A for the same program. What clock rate should we tell the designer to target for machine B?
- 14.) What is the performance of a system that uses 1,000,000 clock cycles to execute a program? The system has a 500 MHz clock.
- 15.) Assume that my computer has only three categories of instructions as shown in the table below. If my computer has a clock speed of 2.0 GHz, how long, in seconds, will it take to execute a 100,000,000 instruction program?

<i>Category</i>	<i>CPI</i>	<i>Frequency</i>
arithmetic	6	20%
memory	3	60%
I/O	21	20%

- 16.) Consider the computer in problem 15 as computer A, and computer B is defined as follows:

<i>Category</i>	<i>CPI</i>	<i>Frequency</i>
arithmetic	10	15%
memory	4	45%
I/O	15	40%

If both computers have the same clock rate, and for any program require the same number of instructions, which will have the better performance?