Computer Organization and Structure

1. Find the word or phrase from the list below that best matches the description in the following questions. Use the numbers to the left of the words in the answer. Each answer should be used only once.

1. virtual worlds	2. operating system
3. desktop computers	4. compiler
5. servers	6. bit
7. low-end servers	8. instruction
9. supercomputers	10. assembly language
11. terabyte	12. machine language
13. petabyte	14. C
15. datacenters	16. assembler
17. embedded computers	18. high-level language
19. multicore processors	20. system software
21. VHDL	22. application software
23. RAM	24. cobol
25. CPU	26. fortran

a. Computer used to run large problems and usually accessed via a network
b. 10^{15} or 2^{50} bytes
c. Computer composed of hundreds to thousands of processors and terabytes of memory
d. Today's science function application that probably will be available in near future
e. A kind of memory called random access memory
f. Part of a computer called central processor unit
g. Thousands of processors forming a large cluster
h. Desktop computer without screen or keyboard usually accessed via a network
i. Currently the largest class of computer that runs one application or one set of related applications
j. Special language used to describe hardware components
k. Personal computer delivering good performance to single users at low cost
l. Program that translates statements in high-level language to assembly language
m. Program that translates symbolic instructions to binary instructions
n. High-level language for business data processing
o. Binary language that the processor can understand
p. Commands that the processors understand
q. High-level language for scientific computation
r. Symbolic representation of machine instructions
s. Interface between user's program and hardware providing a variety of services and supervision functions
t. Software/programs developed by the users
u. Binary digit (value 0 or 1)
v. Software layer between the application software and the hardware that includes the

operating system and the compilers
- w. High-level language used to write application and system software
- x. Portable language composed of words and algebraic expressions that must be translated into assembly language before run in a computer
- y. 10^{12} or 2^{40} bytes

2. For a color display using 8 bits for each of the primary colors (red, green, blue) per pixel and with a resolution of 1280 x 800 pixels, what should be the size (in bytes) of the frame buffer to store a frame?

3. Consider three different processors P1, P2, and P3 executing the same instruction set with the clock rates and CPIs given in the following table.

Processor	Clock rate	CPI
P1	2GHz	1.5
P2	1.5GHz	1.0
P3	3GHz	2.5

- a. Which processor has the highest performance?
- b. If the processors each execute a program in 10 seconds, find the number of cycles and the number of instructions.
- c. We are trying to reduce the time by 30% but this leads to an increase of 20% in the CPI. What clock rate should we have to get this time reduction?

4. Two different sequences (S1 and S2) are being tested on a 2GHz machine with four different classes of instructions. The CPI of each different Instruction Class (I1, I2, and I3) is as the following table.

Instruction Class	Cycle for each Instruction (CPI)
I1	2
I2	4
I3	6

And also, the table below shows the number of different instructions (I1, I2, and I3) used in two different sequences (S1 and S2).

Instruction Class	S1	S2
I1	6 (billion)	13 (billion)
I2	2 (billion)	3 (billion)
I3	2 (billion)	2 (billion)

- a. Which sequence will be faster according to execution time?
- b. Which sequence will be faster according to MIPS?
- c. From these solutions above, you should understand about the execution times used by each Instruction Class (I1, I2, and I3) in sequence S2. According to Amdahl's Law, how much do we have to improve the speed of Instruction Class: **I3** in order to make the sequence **S2** to run **1.25 times faster** on performance?