1. *Computer A*'s performance is 8 times as fast as the performance of *Computer B*, which runs a given application in 32 seconds. How long will *Computer A* take to run that application?

Answer: 32/8 = 4 seconds **5pts**

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2. What is the range of addresses for conditional branches in LEGv8?

Answer: Addresses up to about 1024K before the branch to about 1024K after **5pts**

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3. Consider the following code and assume that the register *X2* contains the address 0×20000000 and the data at address is 0×1907ebfb2345689a. What value is stored in 0×20000008 on a big-endian machine?

Answer: 0x19 **5pts**

---

4. Computers are used in three dissimilar classes of applications. Which one of the following is not one of them?

Answer: Analogue computers **5pts**

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5. The vocabulary of commands understood by a given architecture is called an instruction set.

Answer: True **3pts**

---

6. A command that moves data between memory and registers is called a register instruction.

Answer: False **3pts**

---

7. A value denoting the most recently allocated address in a stack that shows where registers should be spilled or where old register values can be found is called stack pointer.

Answer: True **3pts**

---

8. A systems program that combines independently assembled machine language programs and resolves all undefined labels into an executable file is called linker.

Answer: True **3pts**

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9. Fraction is a numerical quantity that is not a whole number (e.g. 1/2, 0.5). The fraction is also called the exponent.

Answer: False **3pts**

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10. Compilers can have a profound impact on the performance of an application. Assume that for a program, *compiler A* results in a dynamic instruction count of 1.2 10^9 and has an execution time of 1.5 s, while *compiler B* results in a dynamic instruction count of 1 10^9 and an execution time of 1.1 s.

- **a.** Find the average CPI for each program given that the processor has a clock cycle time of 1 ns. Assume the compiled programs run on two different processors.
- **b.** If the execution times on the two processors are the same, how much faster is the clock of the processor running *compiler B*'s code versus the clock of the processor running *compiler A*'s code?

Answer:

a. $CPI_A = 1.25$ **5pts**

$CPI_B = 1.1$ **5pts**

b. Clock Cycle $Time_B$ = 1.37 Clock Cycle $Time_A$ **5pts**

11. Assume a program requires the execution of 100×10^6 FP instructions, 60×10^6 INT instructions, 90×10^6 L/S instructions, and 10×10^6 branch instructions. The CPI for each type of instruction is 1, 1, 4, and 2, respectively. Assume that the processor has a 2 GHz clock rate. By how much must we improve the CPI of L/S instructions if we want the program to run two times faster?

Answer:

Clock cycles = 540 10^6 **5pts**

$CPI_{improved\ L/S}$ = 1 **10pts**

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12. Assuming single precision IEEE 754 format, what decimal number is represent by this word:

0 01111110 11000000000000000000000

Answer: + 0.875 **5pts, 10pts**

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13. Translate the following C code to LEGv8 assembly code. Assume that the values of *i* and *j* are in registers X0 and X1 respectively. Use a minimum number of instructions.

```
while (i > 0) {
        j = j + 4;
        i = i - 1;
}
```

Answer:

```
LOOP:   SUBIS  X0, X0, #0
        B.LE   DONE          5pts
        ADDI   X1, X1, #4    5pts
        SUBI   X0, X0, #1    5pts
        B      LOOP
DONE:
```

5pts