CMPS-2240 Final Exam name ___________________________

1. The MIPS statements below store a value in the **$s0** register, then manipulate the register with some simple operations. After the 5 operations finish, what value will the $s0 register contain?

```
li  $s0, 2          # set $s0 register to the value 2
sll $s0, $s0, 1     # shift left 1 bit
add $s0, $s0, 1     # add 1 to $s0
sll $s0, $s0, 2     # shift left 2 bits
add $s0, $s0, 2     # add 2 to $s0
```

2. When a MIPS register is bit-shifted right by 1, which bit is lost?

   A. the bit in the two's place
   B. the most significant bit
   C. the least significant bit
   D. the left-most bit

3. A binary number can represent a negative number by converting the bits to the two's compliment format. The following byte is in two's compliment format. What is its value? Show answer as a decimal number. Circle your answer.

   11000100

4. Which MIPS command will always cause your program to continue its execution at an address defined by a label?

   A. jmp
   B. jal
   C. j
   D. jr

5. The MIPS **ori** instruction does a bitwise OR operation. What will the **$t4** register contain after the following two commands execute?
   hint: the answer falls within the range 0 to 5.

```
li  $t0, 1         # load 1 into t0
ori $t4, $t0, 3    # bitwise-OR t0 with 3, store in t4
```

6. What is the advantage of a programming language that supports a runtime stack?

   A. Nested function calls can be made.
   B. Programs will run faster.
   C. Nested memory allocation can be done.
   D. Recursive functions are possible.

7. What does this MIPS instruction do?

sw $t0, 8($sp)

A. Writes a value into $t0.
B. Stores a value on the stack.
C. Stores the value 8 into $sp.
D. Swaps two values.

8. After the following statement executes, what do you know to be true?

lw $v0, 8($sp)

A. The stack pointer will be incremented by 8.
B. $v0 will contain the same value as register $sp.
C. The value stored in $sp did not change.
D. $v0 is incremented by 8.

9. What is the purpose of caller-saved registers?

A. to pass values from the caller to the callee.
B. to protect values that the callee might change.
C. to save values the callee will need.
D. to calculate space needed by the callee.

10. The MIPS addi command will accept a negative immediate operand and perform sign-extension. Show the contents of the $a0 register after the following command executes. Show in binary or hex notation.

addi $a0, $0, -20

11. Add the following numbers together and show the result in hexadecimal format.

0x0008
<u>**0x0004**</u>

12. What is the range of signed values that can be stored using just one byte? Show your answer using <u>decimal numbers</u>, not formulas or expressions.

13. A binary number is 1 followed by 15 zeros. What is its value?
Note: The **^** symbol means raised to a power.

A. 2^15
B. 2^16
C. 32768
D. 2^16 - 1 (65535)
E. 2^15 - 1 (32767)

14. Memory addresses refer to the address of...

    A. each bit of memory
    B. registers
    C. each byte of memory
    D. each word of memory

15. Write statements in x86 assembly, using <u>only push and pop</u>, that will copy a value from rax into rcx, then move zero into rax. (4 statements only)

16. Look at the following x86 statements. Just after the statements execute, what value will the **EAX** register hold.

```
xor EAX, EAX   ; zero the EAX register
mov AH, 2      ; move 2 to AH register
shr AX, 1      ; bit-shift AX register one to the right
```

17. When you see the following statement, what is most likely true? Choose all correct answers.

    add BYTE PTR [esi], 10

    A. The esi register is one byte in size.
    B. The esi register holds an address.
    C. Your operating system is 32-bit.
    D. Your operating system is 64-bit.

18. In x86 in-line assembly, what does the following statement do?

    asm ("movl $2, %%ebx");

    A. copies ebx's contents into register $2.
    B. moves ebx's bits 2 places to the left.
    C. stores the constant 2 into register ebx.
    D. stores ebx into variable $2, the 3rd variable.

19. A microprocessor's bus width determines how much memory can be addressed. The width is expressed as the number of bits that can make up an address. A microprocessor with bus width of 20 bits can address how much memory?

20. Show the binary representation of the following decimal number using IEEE 32-bit floating point notation. (sign=1, exponent=8, mantissa=23) Calculate binary precision to at least 15-bits in the mantissa. Show a complete answer. Show your work please.

    33.32