Computer Organization and Operating System Design (CSE 500)

Quiz 2

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Name: _____

(10 pts)

Multiple Choice (20 pts)

1. On MIPS, how are function arguments are passed? (2 pts)
   (a) On the stack
   (b) In registers
   (c) By osmosis
   (d) Via telepathy
2. On MIPS, where is the current function's return address stored? (2 pts)
   (a) In the cloud
   (b) On the stack
   (c) On the heap
   (d) In a register
3. What is the length of MIPS instructions? (2 pts)
   (a) 1 byte
   (b) 4 bytes
   (c) Variable
   (d) 32 bytes
4. What is the private work space dedicated to a function called? (2 pts)
   (a) Stack Frame
   (b) Heap
   (c) Reserve
   (d) Allocation
5. In the case of nested function calls, where are the return addresses of previous functions (i.e. not the current function) stored? (2 pts)
   (a) Heap
   (b) OS Memory
   (c) Registers
   (d) On the stack

6. In the case of nested function calls, where are the arguments that were passed to previous functions (i.e. not the current function) stored? (2 pts)
   (a) Heap
   (b) OS Memory
   (c) Registers
   (d) On the stack
7. Which of the following is NOT a MIPS instruction format? (2 pts)
   (a) R-format
   (b) I-format
   (c) Z-format
   (d) J-format
8. Which instruction should be used to return to the calling function? (2 pts)
   (a) `jl $ra`
   (b) `jr $ra`
   (c) `jump $ra`
   (d) `j $ra`
9. The instruction `addi $sp, $sp, -20` will allocate enough room on the stack to save how many registers? (2 pts)
   (a) 1
   (b) 3
   (c) 5
   (d) 20
10. Assuming that `x` is stored in register `$s0`, choose the MIPS assembly instruction that performs a right shift of `x` by 20 bits and stores the result back in `x` (e.g. `x = x >> 20;` in C). (2 pts)
   (a) `sll $s0, $s0, 5`
   (b) `srl $s0, $s0, 5`
   (c) `sll $s0, $s0, 20`
   (d) `srl $s0, $s0, 20`

Short Answer (20 pts)

For all of the following questions, assume MIPS architecture.

1. Which MIPS instruction format is used for the `sw` instruction? (4 pts)

2. Which MIPS instruction format is used for the `addi` instruction? (4 pts)

3. Which MIPS instruction format is used for the `add` instruction? (4 pts)

4. Which MIPS instruction format is used for the `jal` instruction? (4 pts)

5. Which MIPS instruction format is used for the `slt` instruction? (4 pts)

Functions in MIPS (50 pts)

1. Convert the following C program into MIPS assembly:

```
int stupid_func(int a, int b, int c)
{
    int sa = a + a + a;
    int sb = b + b + b;
    int sc = c + c + c;
    return sa + sb + sc;
}

int main()
{
    return stupid_func(2, 3, 5);
}
```

   Please try to make your program as complete as possible.

   Explicitly declared local variables must be stored in $sX registers.

   You can start with the following assembly:

```
.data
    # Any globals here

.text
.globl main
main:
    # Your main() code here

    # Terminate program run
    # syscall 17 is exit2, which takes a return value.
    # The return value should be loaded into $a0.
    li $v0, 17
    syscall

.globl stupid_func
stupid_func:
    # Your stupid_func() code here
```

   Note that `main()` also returns a value.