Architecture

1. Based on the following information about a computer what can be said about its performance?
   - 30% of the instructions are store and execute in 3 clock cycles
   - 10% of the instructions are load and execute in 3 clock cycles
   - 20% of the instructions are ALU register to register instructions that execute in 1 clock cycle.
   - 5% of the instruction are call instructions that execute in 4 clock cycles.
   - 5% of the instruction are return instructions that execute in 6 clock cycles.
   - 30% of the instructions are branch instructions that execute in 2 clock cycles.
   The control unit clock operates at 100MHz.

   (a) 200 MIPS
   (b) 2.5 MIPS
   (c) 40 MIPS
   (d) 100 MIPS
   (e) 1000 MIPS

2. What is the characteristic of program execution that makes the memory hierarchy a viable mechanism for the implementation of a computer memory system?

   (a) Hit ratio
   (b) Translation lookaside buffer
   (c) Locality of reference
   (d) Cache memory
   (e) Pipelined processors

3. What is the result of adding 1001 to 0111

   (a) 10000, n=1, z=1, v=1, c=1
   (b) 0000, n=0, z=1, v=0, c=1
   (c) 1111, n=1, z=0, v=0, c=1
   (d) 10000, n=0, z=0, v=1, c=0
   (e) 0101, n=1, z=0, v=1, c=0

4. What is the effective memory speed for a computer with the following memory characteristics:
   • cache speed of 5 nsec.
   • main memory speed of 50 nsec.
   • hit ratio of 95%

   (a) 4.75 nsec
   (b) 5 nsec
   (c) 6.25 nsec
   (d) 7.25 nsec
   (e) 9.5 nsec
Data Structures

5. Which of the following sorting algorithms is MORE costly than n*log(n) in the average case?

(a) bubble sort  
(b) heap sort  
(c) quicksort  
(d) radix sort  
(e) none of the above

6. The for loop shown below should terminate (without performing another iteration) as soon as x is strictly greater than 100.

```cpp
for(x=20; ____; x+=5) cout << x << endl;
```

The expression that needs to appear on the blank line is:

(a) x>100  
(b) x<100  
(c) x<=100  
(d) x>=100  
(e) none of the above

7. The following sequence of operations is performed on a queue: q.insert(5); q.insert(6); q.insert(7); q.remove(x); q.insert(9); q.remove(x); The resultant final value of x will be:

(a) 5  
(b) 6  
(c) 7  
(d) 9  
(e) none of the above

8. In a heap, the value stored in a given node is greater than or equal to:

(a) zero  
(b) the value stored in its parent  
(c) the value stored in its left child  
(d) every value stored in one of its descendants  
(e) \ln(\cosh(2\pi/\sqrt{3.00}))

Programming Languages:

9. Which of the following is usually not contained in a subroutine’s activation record if a static chain method is used?

(a) the return address  
(b) values of local variables  
(c) a heap area  
(d) a pointer to the callers activation record  
(e) information used to access non-local variables
10. Why is the issue of left recursion important when developing a recursive descent parser?
   (a) recursive rules cannot be implemented
   (b) terminal symbols must appear as the leftmost symbol in each rule
   (c) left recursion will cause a syntax error
   (d) implementation of left recursive rules cause an infinitely recursive call
   (e) left recursion is not important when developing a recursive descent parser

11. Consider the following program written in a language with syntax similar to C++:

```c
void swap(int a, int b)
{
    int temp;
    temp = a;
    a = b;
    b = temp;
}

void main
{
    int value=2, list[5] = {1, 3, 5, 7, 9};
    swap (list[0], list[1]);
    cout << value << ‘ ‘ << list[0] << ‘ ‘ << list[1] << endl;
}
```

Given that the following output is produced by the program above: 2 1 3 determine which parameter passing method is employed by this programming language.
   (a) passed by value
   (b) passed by reference
   (c) passed by name
   (d) passed by scope
   (e) passed by value-result

12. Use the grammar

```
<expr> ::= <expr> + <term> | <expr> - <term> | <term>
<term> ::= <term> * <factor> | <term> / <factor> | <factor>
<factor> ::= id | ( <expr> )
```

to generate the statement, id + id * ( id - id). The first few steps of a leftmost derivation for the statement are given. What would be the next step?

```
<expr> ::= <expr> + <term>
    ::= <term> + <term>
    ::= <factor> + <term>
```

(a) -> <factor> + <factor>
(b) -> id + <term>
(c) -> id + <factor>
(d) -> id + <term> * <factor>
(e) -> <factor> + id