

**Eastern Mediterranean University
Department of Computer Engineering**

**CMPE 318 Final Exam
2017 – 2018 Fall Semester
11 January 2018**

Name, Surname : _____

Student No : _____

Instructor: Assoc. Prof. Zeki BAYRAM

Duration: 110 minutes

INSTRUCTIONS:

- 1. Please answer all questions.**
- 2. Do not ask any question to the invigilator.**
- 3. GSM phones are not allowed in the exam room.**

1. We are given the following program in a new imperative programming language Tau that is statically scoped. Its statements have the usual meanings and are similar to 'C'. Parameters are always passed by value.

```
void main() {
    int w=6, m=7;

    void g(){
        w++;
        print "sum is", 3+w;
    }

    void h(){
        int z = 4;
        print "sum is", z+w;
    }

    void f(int y){
        if (y<5)
            then h()
            else g();
    }

    f(w);
}
```

Assume static links are used to maintain scope information. For the Tau program above which contains the *main()* function, show the **contents of the system stack** at the point some *print* statement is being executed. Assume *main()* is the first function to be called. Make sure you show all relevant pointers, including the environment pointer EP, the pointer *top*, as well as the local variables, parameters, and other data stored in the activation records. (14 pts)

Answer to question 1:

2. Assume that Tau is statically scoped, and we have the following Tau program. **main()** is the entry point into the program.

```
void main() {
  int x = 3;  int y = 2;  int z = 1;

  void f(int z){
    x--;
    y++;
    z = z + 10;
    g(z);
    print "f:", x+y+z;
  }

  void g(int x){
    x = x*2;
    print "g:", x+y+z ;
  }

  y = x + 10;
  f(y);
  print "main:", x+y+z;
}
```

"print" displays its parameters, and then a new line. What is the output of the program if Tau uses the

- a) By-value parameter passing mechanism ? (6 pts)
- b) By-reference parameter passing mechanism ? (6 pts)
- c) By-value-result parameter passing mechanism ? (6 pts)

3. Given the following Haskell program,

```
secret [] a = a
secret b [] = b
secret (h:t) (f:r) | h < f = (h+f):(secret t r)
                  | otherwise = (h-f):(secret t r)
```

what is the value of the expression `secret [1,6,9,8] [7,2]` ? (10 pts)

Ans: _____

4. Given the following Scheme program,

```
(DEFINE (mystery a)
  (COND ((NULL? a) '(1 3))
        (else (CONS (+ (CAR a) 2) (mystery (CDR a))))))
```

what is the value of the expression `(mystery '(4 7 9))` ? (10 pts)

Ans: _____

5. Assume we have the following definitions in the object-oriented programming language T++, which has similar semantics to Java. Assume all method calls are bound dynamically in T++.

```
class P {  
    char t;  
    float x;  
    int w;  
    static int k;  
    void q(){ ...} // address 200  
    void n() {....} // address 300  
    void i() {....} // address 400  
}  
  
class C extends P {  
    char y;  
    void n(int z){print z+w} // address 500  
    void m(){....} // address 600  
}  
  
class D extends P {  
    float z;  
    void n(){.....} // address 700  
    void r(){.....} // address 800  
}
```

- a) Show the virtual method table for the class D. (10 pts)

b) Into what *function* is the method *n* of class *C* converted by the compiler? Give the full function definition. (8 pts)

c) Assuming a pointer occupies 4 bytes, an integer occupies 4 bytes, a float occupies 8 bytes, and a character occupies one byte, how many bytes does an instance of class *C* occupy? (4 pts)

d) Assume we have the following definition.

```
D x = new D();
```

Show the internal structure of the object pointed at by the variable *x*. (8 pts)

6. Fill in the blanks. (2 pts each)

- i. The ability of a pointer variable to point at an object that belongs to a subclass of the class that is the type of that variable is called _____.
- i. The keyword _____ is used in C++ to denote that a method will be called dynamically.
- ii. A/An _____ subprogram is one that has the same name as another subprogram in the same referencing environment.
- iii. A/An _____ class cannot be instantiated.
- iv. A/An _____ is placed on the system stack for each function call.
- v. In C++, the _____ mechanism is used to define classes where types are parameterized.
- vi. In the _____ implementation of dynamic scoping, non-local references are found by searching the activation record instances on the dynamic chain.
- vii. In a C++ class definition, if a variable is declared in the scope of a _____ clause, then that variable is not visible in child classes.
- viii. A _____ is an implicitly called method, mainly used to initialize the data members of an instance.
- ix. In C, files containing one or more subprograms can be independently compiled. The interface to the subprograms in such a file is placed in a _____ file.