1. Consider the following attribute grammar:

Grammar rule	Semantic rules
1) S → A B C	B.u = S.u A.u = B.v + C.v S.v = A.v
2) A → a	A.v = 2 * A.u
3) B → b	B.v = B.u
4) C → c	C.v = 1

(a) Draw the parse tree for the string abc and draw the dependency graph for the associated attributes. Describe a correct order for the evaluation of the attributes. (15%)

(b) Suppose that S.u is assigned the value 3 before attributes evaluation begins. What is the value of S.v when evaluation has finished? (5%)

(c) Suppose the attribute equations are modified as follows:

Grammar rule	Semantic rules
1) S → A B C	B.u = S.u C.u = A.v A.u = B.v + C.v S.v = A.v
2) A → a	A.v = 2 * A.u
3) B → b	B.v = B.u
4) C → c	C.v = C.u - 2

What value does S.v have after attribute evaluation, if S.u = 3 before evaluation begins? (5%)

2. (a) Show that the following grammar is not LR(1): (10%)

A → a A a | ε

(note: ε is empty)

(b) Is this grammar ambiguous? Why or why not? (5%)

3. The following program is in a block structure language (e.g., PASCAL like):

```
procedure A;
    var x, y: integer;
    procedure B;
        var z: integer;
        procedure C;
            var x, u: integer;
            begin
            …
            end;
        begin
        …
        end;
    procedure D;
        var y: integer;
        begin
        …
        end;
begin
…
end;
```

If the static most closely nested scope rule is applied to the variable declaration, please answer the following questions:

(a) What is the attribute should be recorded in symbol table, so that the above rule can be implemented? (5%)

(b) How to access a nonlocal variable? (5%)

4. What is Java Virtual Machine (JVM) ? Why does JVM use a stack-based instruction set ? (10%)

5. List all possible components of a *thread* ? What kinds of resources are shared by peer threads ? (10%)

6. The performance of the Round Robin scheduling depends heavily on the size of the time slice. Explain why ? Should we shorten the time slice as much as possible ? (10%)

7. What is the cause of thrashing ? How does the system detect thrashing ? (10%)

8. In what situations would using memory as a RAM disk be more useful than using it as a disk cache ? (10%)