King Fahd University of Petroleum and Minerals

Department of Information and Computer Science

ICS 313-02
(002)

Fundamentals of Programming Languages

EXAM I
(50 Minutes)

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Name : _____

Question No	Maximum points	Student points
1	8	
2	8	
3	8	
4	8	
5	8	
Total	40	

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Question 1: **(8 points)**

1.1 Computers have been applied to a myriad of different areas, because of this great diversity in computer use, programming languages with very different goals have been developed.

Name computer programming languages that match the following four areas of computer applications.

Areas of computer applications	Computer language
Scientific application	_____
Business applications	_____
Artificial Intelligence applications	_____
System programming	_____

1.2 Complete the given statements by the following:

Artificial intelligent languages
Business languages
Scientific languages
System programming languages

a: _____are characterized by elaborate input and output facilities and decimal data types.

b: _____ are characterized by the use of low-level features that allow the software interfaces to external devices to be written.

c: _____ are characterized by the absence of exact algorithms and the use of symbolic computation rather than numeric computation.

d: _____ are characterized by the use of simple data structures but requires large number of floating-point arithmetic computations.

Question 2: **(8 points)**

Complete the following statements:

1. **_____ was recognized as a major part of the software life cycle, particularly in terms of cost.**
2. **_____ problem occur whenever the program's author learned a different subset from that subset with which the reader is familiar.**
3. **_____ means the ability to define and then use complicated structures or operations in ways that allow many of the details to be ignored.**
4. **_____ in a programming language means that a relatively small set of primitive constructs can be combined in a relatively small number of ways to build the control and data structures of the language.**
5. **_____ in a language means that a language has relatively convenient, rather than cumbersome, ways of specifying computations.**
6. **_____ is the ability of a program to intercept run-time errors, take corrective measures, and continue to execute.**
7. **_____ is having two distinct referencing methods, or names, for the same memory cell.**
8. **A program is said to be _____ if it performs to its specifications under all conditions.**

Hint: Abstraction, compilation, interpretation, expressivity, aliasing, readabiliy, writability, reliability, exception handling, maintenance, orthogonolity, simplicity, cost.

Question 3: **(8 points)**

3.1 Modify the grammar to add a unary operator that has higher precedence than either + or *.

<assign> → <id> := <expr>
<id> → A | B | C
<expr> → <expr> + <term> | <term>
<term> → <term> * <factor> | <factor>
<factor> → (<expr>) | <id>

3.2 Parsing is the process of tracing or constructing a parse tree for a given input string. The basic idea of recursive decent parser is that there is a subprogram for each nonterminal in the grammar.

Describe the responsibility of the subprogram for a particular nonterminal when given an input string.

Question 4: **(8 points)**

4.1 Complete the following:

A _____ is an abstraction of memory cell.

A variable can be characterized as a sextuple of attributes: _____ , _____, _____, _____, _____, and _____.

A _____ is an association, such as between an operation and a symbol.

The _____ variables of a program unit are those that are visible but not declared in it.

4.2 Consider the following declaration statements:

```
type
     T1 : array[1..5] of integer;
     T2 : array[1..5] of integer;
     T3 = T1;
var
     X, Y : T1;
     Z : T2;
     W : T3;
```

Complete the following statements:

1. **X and Y are type compatible using _____ compatibility.**
2. **X and Z are type compatible using _____ compatibility.**
3. **X and W are type compatible using _____ compatibility.**

Question 5: **(8 points)**

Consider the following program:

```
Program main;
        var x, y, z, : integer;
        procedure sub1;
                var a, y, z: integer;
                begin { sub1 }
                …
                end; { sub1 }
        procedure sub2;
                var a, x, w : integer;
                procedure sub3;
                        var a, b, z : integer;
                        begin { sub3 }
                        …
                        end; { sub3 }
        begin { sub2 }
        …
        end; { sub2 }
begin { main }
…
end. { main }
```

5.1 List all variables, along with the program units where they are declared, that are visible in the bodies of sub1, sub2, and sub3, assuming *static scoping* is used.

5.2 Given the following calling sequence: **main** calls **sub2**; **sub2** calls **sub1**

Assuming *dynamic scoping* is used; list all variables, along with the program units where they are declared, that are visible during execution of the last subprogram activated?

5.3 Dynamic scoping can be used as a convenient method of communication between program units, although it is less safe than parameter passing.

Given the calling sequence in 5.2: what are the variables that are passed by dynamic scoping in the above program?