King Fahd University of Petroleum and Minerals

Department of Information and Computer Science

ICS 535-01
(051)

Design and Implementation of Programming Languages

MID-TERM EXAM

(75 Minutes)

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Student ID :_____

Name : _____

Question No	Maximum points	Student points
1	15	
2	15	
3	15	
4	10	
5	10	
6	15	
Total	80	

Oct. 15, 2005

Question 1: **(15 points)**

1.1 List five reasons to study programming languages.

1.2 List the attributes of a good programming language.

1.3 List the four programming languages paradigms, what is the syntax format for each?

Question 2: **(15 points)**

2.1 What is the difference between static and dynamic semantics, give an example for each?

2.2 What are the cases for using a compiler and the cases for using an interpreter?

2.3 Write a BNF for a language of the following format:

```
Integer  x, y, z
Real  i, j, k
x =  3
If ( x >= I ) then
     x = j
endif
print  x, j
```

Question 3: **(15 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 Complete the following table:

Chomsky Hierarchy	Grammars	Languages	Minimal automaton
Type-2	Context-free		
Type-3	Regular	Regular	

3.3 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 non-terminal in the grammar.

Describe the responsibility of the subprogram for a particular non-terminal when given an input string.

Question 4: **(10 points)**

4.1 What characterizes functional programming languages?

4.2 How do you evaluate *Common Lisp* as a purely functional programming language?

Question 5: **(10 points)**

Given the following code in Common Lisp and Fortran:

```
(defun power ( num1 num2)
     (let (( result 1))
     (dotimes (count num2 result)
          (setf result (* num1 result)))))
(power 2 3)
```

```
     Integer Function power (num1 num2)
     Integer num1, num2
     Power = 1
     Do 100 I= 1, num2
          Power = Power * num1
100  continue
     return
     end
     print *, power (2 , 3)
```

5.1 Evaluate the two program codes in terms of readability, writability, naturalness to the problem, abstraction.

5.2 Evaluate the *dotimes* construct in Common Lisp in terms of its uniformity with functional programming syntax.

Question 6: **(15 points)**

You are asked to design and implement a special purpose language for teaching programming to 1st grade students. From a language-designer point of view, what are the main ***design and implementation*** issues.