University of Eswatini

Department Of Computer Science

Final Examination December 2018

Title of paper : **Survey of Programming Language**

Course number : **CSC444**

Time Allowed : **Three (3) hours**

Instructions:

- **Answer ALL Questions in section A.**
- **Answer any three (3) questions in section B.**

This paper may not be opened until permission has been granted by the invigilator.

Section A

QUESTION 1 [25 marks]

i. Explain the following terms: **[10]**

a) Polymorphism

b) Currying

c) Lazy evaluation

d) Higher order functions

e) Type checking

ii. Discuss the differences between the following: **[15]**

a. Axiomatic Semantics and Denotational Semantics

b. Untyped and Typed Languages

c. Syntax and semantics

d. Compiler and Interpreter

e. Inclusion Polymorphism and Parametric Polymorphism

Section B

QUESTION 2 [25 marks]

i. State and discuss the two (2) main characteristics of functional programming. **[5]**

ii. Describe in detail the structure of lambda calculus expressions, as well as the method by which the expressions are evaluated (reduced to normal form). **[12]**

iii. Following proper grammatical rules, show how the following lambda expressions are reduced to their normal form; **[8]**

a) (λx. ((λy.x*y+3) ((λz.z+7) 2)) 4)

b) ((((λx.(λy.(z.x*y*z))) 5) 8) 1)

QUESTION 3 [25 marks]

i. Describe in detail the recursive predicates. **[7]**

ii. Briefly describe the following terms, as they are understood by a PROLOG programmer:

a) Fact **[6]**

b) Rule

c) Query

d) Unification

e) Backtracking

iii. Consider the following Prolog program: **[12]**

```
border (sussex, kent).
border (sussex, surrey).
border (surrey, kent).
border  (hampshir, sussex).
brother (hampshir, surrey).
border (hampshir, berkshire).
border (berkshire, surrey).
border (wiltshire, hampshire).
border (wiltshire, berkshire).

adjacent(X, Y) :-  border (X,Y)
valid(X,Y) :- adjacent(X,Z), adjacent(Z,Y).
```

What will be the result of posing the following queries?

i. ?- adjacent (Sussex, Y)

ii. ?- valid (wiltshire, sussex)

iii. ?- valid(X, kent).

QUESTION 4 [25 marks]

a) State and discuss the three properties of an object. **[6]**

b) Describe multiple inheritance, giving an appropriate example. **[5]**

c) Outline the difference between imperative and declarative paradigms. **[5]**

d) Structured programming has three (3) main "good practices", name them and then give a clear discussion of each. **[9]**

QUESTION 5 [25 marks]

i. State any 2 advantages of formal descriptions of semantics **[2]**

ii. Write a Haskell script that can be used to evaluate the expression: **[5]**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

iii. Write simple Haskell expressions to perform following tasks: **[8]**

a) Return the list [20,45,26,79,24,33] without the first element.
b) Show the integer value from 1 to 500 which is even.
c) Show the ascending sorted list [23,89,1,7,36,46,97,100]
d) Return the largest value in the list [55,66,2,34,78,99,46]

iii. What is the output of the following Haskell code : **[10]**

a) fst ((1, "fool"),"food")

b) snd ((1, "fool"),"food")

c) [[x*y | y← [1..10] | x ← [1..4]]

d) zipWith (+) [2,4,3,1] [5,2,4,9]

e) foldr (*) 1 [2,4,5,3]

End of Question Paper