University of Swaziland

Department Of Computer Science

Main Examination December 2017

Title of paper : **Programming Languages**

Course number : **CS343**

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.

QUESTION 1 [25 marks]

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

a) Translators
b) Axiomatic Semantics
c) Functional abstraction
d) Higher order functions (HOFs)
e) Recursive predicates

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

a. Syntax and Semantics
b. Static typing and Dynamic typing
c. Inclusion Polymorphism and Parametric Polymorphism
d. Statements and Expressions
e. Selection control structure and repetition control Structure

QUESTION 2 [25 marks]

i. Discuss (in detail) language classification, making sure that you include all the paradigms. **[9]**

ii. Pascal, C++ and other high-level languages are known as typed languages. Write down the main three (3) advantages over untyped languages. **[6]**

iii. Describe in detail the structure of Lambda calculus expressions, as well as the method by which the expressions are evaluated (reduced to normal form) **[10]**

QUESTION 3 [25 marks]

i. State any 3 reasons why we study concepts of programming languages **[3]**

ii. Discuss (in detail) low level (LL) programming, stating the main reasons why it mostly avoided. **[7]**

iii. Most languages have about seven (7) ways of defining new types, name and describe any five of these ways giving a fragment of code as an example. **[15]**

QUESTION 4 [25 marks]

i. A logic programming system, such as Prolog, is made of which two (2) main components? **[3]**

ii. Name and discuss any Six (6) prolog predicates, giving appropriate examples. **[12]**

iii. For given English statements about Food, write a prolog program and each case write the expected answer to the query. **[12]**

- Facts & Rules
(1) burger is a food.
(2) sandwich is a food.
(3) pizza is a food.
(4) sandwich is a lunch.
(5) pizza is a dinner.
(6) Every food is a meal OR Anything is a meal if it is a food.

- Goals.
(1) Is pizza a food?
(2) Which food is meal and lunch? OR What is both meal and lunch?
(3) Is sandwich a dinner?

QUESTION 5 [25 marks]

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

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

a) (λx. ((λy.x*y+2) ((λz.z+1) 9)) 3)
b) ((((λx.(λy.(z.x*y*z))) 1) 2) 3)

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

a) fst ((7, "cool"),"cool")
b) snd ((1, "cool"),"cool")
c) [[x*y | y← [1..7] | x ← [1..4]]
d) zipWith (+) [2,4,3,1] [3,2,4,7]
e) foldr (*) 1 [2,4,5,8]

iv. Write and expression Haskell function to produce a list of all even integers between 50 and 100, inclusive. **[2]**

End of Question Paper