

University of Swaziland

Department of Computer Science

Final Examination

2014/15

Title of Paper: Programming Languages

Course Number: CS343

Time Allowed: Three (3) hours

Instruction: ANSWER ALL QUESTIONS

You are not allowed to open this paper until you have been told to do so by the invigilator.

Question 1

- a) State and discuss the two main characteristics of functional programming. [6]
- b) Define lambda calculus and state its two uses. [3]
- c) Reduce the following λ -calculus expression to normal form:
- $(\lambda Y. Y Y) ((\lambda X.X) (\lambda Z.Z))$ [3]
 - $((\lambda x.((\lambda y.(x y))x))(\lambda z.w))$ [4]
 - $(((\lambda f.(\lambda g.(\lambda x.((fx)(g x)))))(\lambda m.(\lambda n.(n m))))(\lambda n.z))p$ [9]

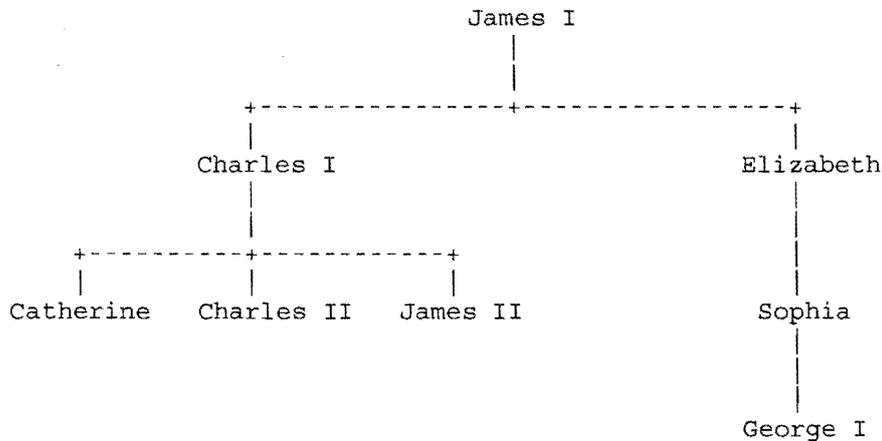
Question 2

- a) What is your understanding of user-defined types? [2]
- b) Define abstraction. [2]
- c) State 3 reasons why low level languages are mostly avoided. [3]
- d) Discuss the following:
- Overloading polymorphism. [3]
 - Conversion polymorphism. [3]
- e) From the list of languages below state which of them are statically typed and which are dynamically typed:
- Pascal [1]
 - Prolog [1]
 - Java [1]
 - Javascript [1]
 - C++ [1]
 - Haskell [1]
 - Logo [1]

- f) Why is overloading not possible in untyped languages. [2]
- g) In structured languages, for example, a program can be decomposed into smaller units called functions and procedures. What are these units called in concurrent languages? [1]
- h) Languages of the imperative paradigm are said to have statement-oriented syntax. What does that mean? [2]

Question 3

- a) Name the 3 defining properties of an object. [3]
- b) How is dynamic dispatch achieved? [5]
- c) What is the difference between unification and backtracking? [2]
- d) State and discuss the 2 main components of a logic programming system. [4]
- e)



Formulate prolog queries for the following statements:

- i. Was George I the parent of Charles I? [2]
- ii. Who was Charles I's parent? [2]
- iii. Who were the children of Charles I? [2]

