University of Swaziland

Department of Computer Science

Final Examination

2013/14

Title of Paper: Programming Languages

Course Number: CS343

Time Allowed: Three (3) hours

Instructions: 1) This paper has five (5) questions and each carries 25 marks.

*2) Section A is **COMPULSORY.***

3) Answer any two (2) questions in Section B.

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

SECTION A (COMPULSORY)

Question 1

a) Describe a compiler, stating its advantages as well. [5 marks]

b) Discuss (in detail) low level (LL) programming, stating the main reasons why it is mostly avoided. [8 marks]

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

d) Define the following:

I. Arity [1 mark]

II. Fixity [1 mark]

III. Precedence [1 mark]

Question 2

a) Write a Haskell expression of the form:

`let str=`*any string*

`in ...`

that returns the number of occurrences of the 2 lower-case characters `'x'` and `'y'` in the given string (`str`). E.g. if `str` is "`your excellency`" the expression must evaluate to 3. [6 marks]

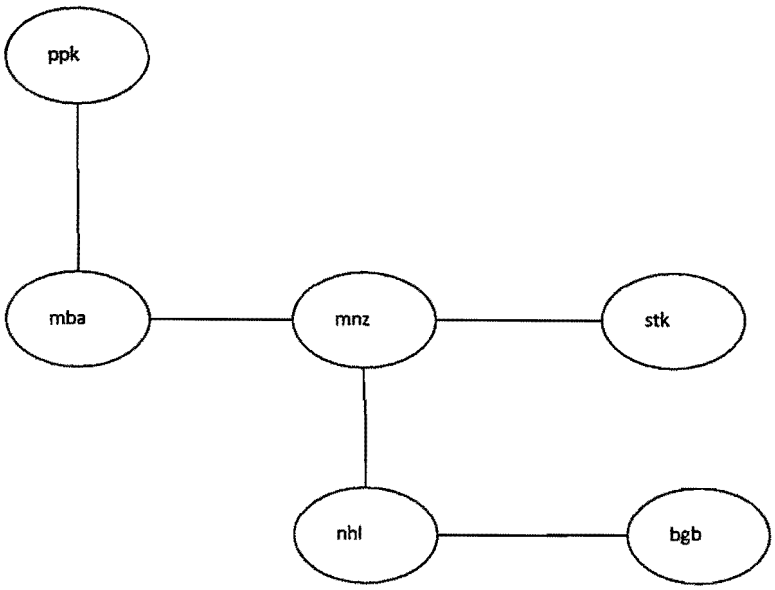
b) Write a Haskell expression of the form:

`let n=`*any positive integer*

`in ...`

that returns a list of integers starting with `n` and ending with 0, and where each item is the quotient (integer part) of dividing its predecessor by 2. E.g. if `n` is 57, the expression must evaluate to `[57, 28, 14, 7, 3, 1, 0]`. You are permitted to assume that `n` will never be zero or negative. [7 marks]

c)



Define a Prolog rule of the form:
`link(Town1, Town2) :- ...`

that succeeds when `Town1` and `Town2` are directly linked by a single road. E.g. based on the above map, the queries `link(mnz, mba)` and `link(mba, mnz)` must succeed, while `link(mnz, ppk)` must fail. [5 marks]

d) Define a Prolog rule of the form:
`remote(Town) :- ...`

that succeeds when `Town` has fewer than 3 nearby towns, with the special exception of `mba`. E.g. based on the above map, only the queries `remote(mnz)` and `remote(mba)` must fail. [7 marks]

SECTION B

Question 3

a) Discuss (in detail) the advantages of typed languages over untyped languages.

[10 marks]

b) Most languages have about seven (7) ways of defining new types, name and describe any five (5) of these ways giving a fragment of *code* as an example. [15 marks]

Question 4

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

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

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

d) Outline the difference between imperative and declarative paradigms.

[5 marks]

Question 5

a) Name and discuss any three (3) prolog predicates, giving appropriate examples.

[9 marks]

b) Other than *Referential Transparency and Higher-Order Functions (HOFs),* state and discuss the any other four (4) characteristics/features of functional programming.

[12 marks]

c) Show how the following λ–calculus expression is reduced to normal form:

$$(((\lambda x.x)\ (\lambda y.y*y))\ ((\lambda z.z+1)\ 2))$$ [4 marks]

End!!!