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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY **UNIVERSITY EXAMINATIONS, 2024/2025 ACADEMIC YEAR** THIRD YEAR, SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (COMPUTER SCIENCE)

KCS 2303: PROGRAMMING PARADIGMS

DATE: 9TH DECEMBER, 2024 TIME: 2:30PM-4:30PM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS OUESTION ONE: COMPLIESORY (30 MARKS)

Y	<u>CEDITOR ORE COM CEDORI (SUMMAD)</u>						
a)) Explain the following terms as used in programming:						
	i) Programming language	(1 Mark)					
	ii) Data item	(1 Mark)					
	iii) Programming paradigm	(1 Mark)					
b)	Using the following program statement, determine:						
	i) One possible precondition	(1 Mark)					
	ii) The weakest precondition for both j and k	(2 Marks)					
	$\{ j > 3 \text{ and } k > 4 \} j = j + k \{ j > 8 \text{ and } k > 4 \}$						
c)	Using an example of a program fragment in any programming language differentia	te between:					

- i) Type inference (3 Marks) ii) Type coercion
 - (3 Marks)
- d) From the point of view of a programmer identify three major advantages of using a high-level language rather than internal machine code or assembler language. (3 Marks)
- e) Code optimization is the process of improving the efficiency, performance, and overall quality of software code without changing its functionality. Describe three reasons why programmers have to undertake this process. (6 Marks)
- f) Imperative programming was the dominant paradigm from the dawn of computing until about 1990, after which it was overtaken by object-oriented programming. Explain this development and justify why functional or logic programming has never become dominant? (5 Marks)
- g) Consider the following fragment of code in a language with static scope and parameter passing both by value and by name:

```
{int z=0;
int Omega(){
return Omega();
}
int foo(int x, int y){
if (x==0) return x;
else return x+y;
}
write(foo(z, Omega()+z));
```

- i) Identify the result of the execution of this fragment in the case in which the parameters to *foo* are passed by name. (2 Marks)
- ii) State what will be the result of the execution of this fragment in the case in which the parameters to *foo* are passed by value. (2 Marks)

QUESTION TWO: (20 MARKS)

Using a class example in an object-oriented language, describe the concept of data abstraction in program a) (4 Marks) development.

- b) Iteration allows the expression of loops in an implicit fashion, including the possibility that a function (or procedure) can call itself, thereby repeating its own body an arbitrary number of times. Using examples compare the bounded and unbounded iteration. (4 Marks)
- c) Develop code fragments to illustrate the following concepts using your preferred programming language:

i)	Class inheritance	(3 Marks)
ii)	Recursion	(3 Marks)

(3 Marks) iii) Polymorphism

b) Using a real life example, discuss three security issues arising from running code on an alien machine.

OUESTION THREE: (20 MARKS)

a) Describe the following terms as used in programming, give example for each case:

- i) Lazy evaluation (2 Marks) (2 Marks)
- ii) Eager evaluation
- iii) Normal evaluation
- b) Discuss five key reasons why it is important to have an international standard for any programming (5 Marks) paradigm.
- c) "A logic program written in the Prolog programming paradigm specifies what a program should do and not how it does it." With reference to this statement, discuss the differences between a logic programming paradigm and an imperative programming paradigm. (6 Marks)
- d) Define, in any programming language, a function, f, such that the evaluation of the expression (a + f(b)) * (c + f(b)) when performed from left-to-right has a result that differs from that obtained by evaluating right-to-left. (3 Marks)

QUESTION FOUR: (20 MARKS)

- a) Discuss six goals (reasons) for studying the formal semantics of programming paradigm (6 Marks)
- b) The best programming paradigm for a particular problem depends on the specific characteristics of the problem. Describe three characteristics of a good programming paradigm. (3 Marks)
- c) Consider the following function:

int ninetyone (**int** x){ **if** (x>100) return x-10; else **return** ninetyone(ninetyone(x+11));

(3 Marks)

(3 Marks)

(2 Marks)

Is this tail recursive? Justify your answer. d) Object-oriented programming is one of the programming paradigms that are in wide use today. Explain the following terms as used in Object Oriented programming.

5	1	0	6	
				(2 Marks)
	5		5 1 0	

OUESTION FIVE: (20 MARKS)

- a) Differentiate between declarative and non-declarative programming paradigm. (4 Marks) (6 Marks)
- **b**) Outline six main features of functional programming paradigm.
- c) Explain why object oriented programming paradigms have become very popular as compared to other paradigms. (6 Marks)
- d) Consider the following fragment in a pseudo-language with reference-based variables and which uses locks and keys (C is a class whose structure is of no importance):

C foo = new C(); // object OG1C bar = new C(); // object OG2C fie = foo;bar = fie;

Give possible values after the execution of the fragment for all the keys and all the locks involved.