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NATIONAL OPEN UNIVERSITY OF NIGERIA

University Village, Plot 91, Jabi Cadastral Zone, Nnamdi Azikiwe Expressway, Abuja

FACULTY OF SCIENCES

Computer Science Department

2023_1 POP EXAMINATION

Course Code: **CIT308**

Course Title: **Formal Methods and Software Development**

Credit: **3 Units**

Time Allowed: **2½ hours**

Instruction: **Answer Questions One (1) and any other THREE (3) questions**

Questions One (25 Marks) – Compulsory

- 1 (a) Enumerate four (4) benefits of using formal methods in software development. **(4 marks)**
- 1 (b) Fully describe one (1) formal methods technique. **(3 marks)**
- 1 (c) Discuss three (3) important considerations of software verification when dealing with a formal system. **(6 marks)**
- 1 (d) Briefly explain any six (6) of the following terminology.
- Conjecture/Hypothesis
 - Axiom/Postulate
 - Paradox/Antinomy
 - Theorem
 - Un-decidable

- Lemma
- Converse

(6 marks)

- 1 (e) Using two (2) examples each, briefly explain the following testing concepts
- (i) Test flow
 - (ii) Test size
 - (iii) Test depth

(6 marks)

Question 2

- 2 (a) Discuss the 7 stages of the SDLC, and explain what each stage entails. (10 marks)
- 2 (b) Explain three (3) strengths and two (2) weaknesses of the waterfall model.

(5 marks)

Question 3

- 3 (a) Discuss two (2) types of critical systems. (4 marks)
- 3 (b) Given the following
- $A = \{1, 2, 5, 7, 9, 15\}$
- $B = \{-1, 3, 5, 8, 15\}$
- $C = \{2, 4, 6, 8, 15\}$

Calculate the following

- i. $A \cup B$
- ii. $A \cup C$
- iii. $B \cup C$
- iv. $A \cup B \cup C$
- v. Show your results in a Venn diagram

(11 marks)

Question 4

- 4 (a) Describe any three (3) stages in formal methods. (6 marks)
- 4 (b) (i) State the formula for a geometric sequence.
- (ii) Given: $X = 4, 16, 64, 256, 1024$, Calculate the 10th term. (3 marks)
- 4 (c) Discuss four (4) limitations of formal methods. Give one (1) instance each when to introduce formal methods into new and existing systems. (6 marks)

(6 marks)

Question 5

- 5 (a) List and explain with examples three (3) types of proofing methods. **(9 marks)**
- 5 (b) Describe Arithmetic and Geometrical Sequences with appropriate examples. **(6 marks)**

Question 6

- 6 (a) Differentiate between a data flow and control flow in a structure chart. **(6 marks)**
- 6 (b) Describe any two (2) results of software design levels. **(3 marks)**
- 6 (c) Explain any four (4) of the following Object-Oriented Design concepts:
- Objects
 - Classes
 - Encapsulation
 - Inheritance
 - Polymorphism
- (6 marks)**