



FOUNTAIN UNIVERSITY, OSOGBO, NIGERIA.

P.M.B.4491, OSOGBO, OSUN STATE.

COLLEGE OF NATURAL AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICAL AND COMPUTER SCIENCES

SECOND SEMESTER EXAMINATION 2021/2022 SESSION

CPS 204: DISCRETE STRUCTURES

Credit Unit/Status: 2 (C)

Time Allowed: 1hour: 45minutes

15/08/2022

INSTRUCTION(s): ATTEMPT ALL QUESTIONS IN SECTION A & ANY ONE (1) IN SECTION B.

SECTION A

Question 1

[10marks]

- i) Using a suitable example, describe the following terms:
- i. Proposition ii. Truth value iii. Tautology
- iv. Contradiction v. Argument
- ii) Determine whether each of the following is a tautology, a contradiction or neither:
- (i) $(p \wedge q) \wedge (p \vee q)$ (ii) $[(p \vee q) \rightarrow r] \vee (p \vee q)$ [5marks]
- iii) State the converse, inverse and contrapositive of the proposition "If I work hard, then I will get rewarded." [3marks]
- iv) Symbolize the following arguments and provide a formal proof of the validity of each: [3½marks each]
- i) If you have body pains or fever then you have malaria or typhoid. You have body pains; therefore, you have malaria.
- ii) You will be gainfully employed if and only if you graduate from high school. If you are gainfully employed then you won't be poor. Therefore, you either be poor or graduate from high school but not both.

Question 2

[6marks]

- i) Translate the following into symbolic form using one-place predicates. Define predicates used and, where necessary, define the universe of discourse. [6marks]
- i) All human beings are equal.
- ii) Some students can't write good essays.
- iii) There are people who have had a university education and still live in poverty.
- b) Consider the following predicates:
- $P(x, y) : x > y$,
- $Q(x, y) : x \leq y$
- $R(x) : x - 7 = 2$

If the universe of discourse is the real numbers, give the truth value of each of the following propositions: [8marks]

- (i) $\exists x R(x)$ (ii) $\forall y [\neg R(y)]$ (iii) $\forall x \exists y P(x, y)$ (iv) $\exists y \forall x Q(x, y)$
- c) Let A be any set of propositions not all of which have the same truth values. Define a relation R on A by: $p R q$ if and only if $p \rightarrow q$ is true. Which of the four properties is satisfied by this relation? Justify your answers. [6marks]

SECTION B

Question 1

- a) Use the notation $\{x: P(x)\}$, where $P(x)$ is a propositional function, to describe each of the following sets. [3marks]
- (i) The set of all integers less than 100 which are perfect squares.
 - (ii) {Abdulsalami, Azeez, Lawal, Ogunrinde, Owolabi, Shittu}
- b) Determine which, if any, of the properties of relations is satisfied by each of the following relations on the set \mathbb{Z}^+ .
- (i) $n R m$ if and only if $n - m$ is a multiple of 2. [4½marks]
 - (ii) $n R m$ if and only if $n = 2^k m$ for some $k \in \mathbb{Z}^+$ [4½marks]
- c) List the elements of each of the following sets, using the ' \dots ' notation where necessary:
- (i) $\{x: x \text{ is an integer and } -7 < x < 6\}$
 - (ii) $\{x: x \text{ is a real number}\}$
 - (iii) $\{x: x = y^2 \text{ and } y \text{ is an integer}\}$ [3marks]

Question 2

- a) Given a set of integers A , defined as $A = \{k \in \mathbb{Z} : k \leq 4\}$, for each of the following relations R on a set A :
- (i) $a R b$ if and only if $a \leq b$ (ii) $a R b$ if and only if $a/b \in \mathbb{Z}$
- Draw its coordinate grid diagram, its directed graph, and its binary matrix. [7½marks]
- b) Let $P = \mathbb{Z}^+ \times \mathbb{Z}^+$ and R be the relation on P defined by $(a, b) R (c, d)$ if and only if $a + d = b + c$. Show that R is an equivalence relation. [3marks]
- c) Suppose the following predicates and individual are defined:

S : Students

A : attend classes

F : fail the examination

Symbolize the following:

- (i) If Students does not attend classes, then they may fail the examination.
- (ii) Students does not like to attend classes but they do not want to fail the examination.
- (iii) Everyone who attends classes will not fail the examination.

[4½marks]