



University of Vavuniya

First Examination in Information Technology - 2019

First Semester - December 2020/January 2021

Held on October/November 2021

IT1122 Foundation of Mathematics

Online Examination

Question-Set 2 of 2

- Time Allowed : **30 Minutes**
- Answer any **one** question only.
- This is a closed-book examination.

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2. (a) State the *converse*, *contrapositive*, and *inverse* of the following conditional statement.

“If the square of an integer m is even, then the integer m must be even.” [15%]

- (b) Show that $\neg(p \vee (\neg p \wedge q))$ and $\neg p \wedge \neg q$ are logically equivalent using Boolean algebra identities. [15%]

- (c) Prove each of the following using truth table:

i. $(p \longrightarrow q) \longleftrightarrow (\sim p \vee q)$ is a tautology.

ii. $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$ [30%]

[This question is continued on the next page/

(d) Express each of the following statements in a symbolic form by defining propositions:

- i. "I am innocent and i have an alibi."
- ii. "If the label does not read 'POISON' then i can drink it."
- iii. "You can take the flight if and only if you buy a ticket."
- iv. "You cannot ride the roller coaster if you are under 4 feet tall unless you are older than 16 years old."

[20%]

(e) Express each of the following statements in symbolic form using quantifiers, predicates, and logical connectives:

- i. "All hummingbirds are richly colored."
- ii. "No large bird live on honey."
- iii. "There is an adult in your neighbourhood who knows kung-fu but not karate."
- iv. "Not everybody is your friend or someone is not perfect."

[20%]

3. (a) Using properties of Boolean algebra, simplify each of the following functions:

i. $(A + B)(A + C)$

ii. $\overline{AB}(\overline{A} + B)(\overline{B} + B)$ [20%]

(b) Simplify each of the following Boolean expressions using Karnaugh map:

i. $F(A, B, C) = \bar{A}\bar{B}\bar{C} + \bar{A}BC + \bar{A}B\bar{C} + A\bar{B}\bar{C} + A\bar{B}C + ABC$

ii. $F(A, B, C) = \bar{A}BC + A\bar{B}C + ABC\bar{C} + ABC$ [20%]

(c) Draw a reduced circuit for the simplified Boolean expressions obtained in part (b). [20%]

(d) Define a Finite State Machine. [10%]

[This question is continued on the next page]

- (e) Consider the finite-state machine M defined by the state table shown in Table 1.

Table 1

State	Input	
	0	1
S_0	S_1	S_2
S_1	S_1	S_2
S_2	S_3	S_4
S_3	S_1	S_2
S_4	S_3	S_4

Draw the state diagram for the finite state machine M.

[30%]