

**Mid-Semester Examination, October-2016**  
**Discrete Mathematics (CSE 1002)**

Semester: 1<sup>st</sup> Semester

Full mark: 30

Branch: CSE & CSIT

Time: 2 Hours

Subject Learning Outcome	*Taxonomy Level	Ques. No.	Marks
Analyze and Apply rules of logic to distinguish between valid and invalid arguments, prove mathematical statements and verify the correctness of program.	L3, L3, L3, L2, L3, L3	1(a), 1(b), 1(c), 2(a), 2(b), 2(c)	2,2, 2,2, 2,2
Analyze the searching and sorting algorithms and use the growth of functions to study the time complexity of algorithms.	L3, L3, L3	3(a), 3(b), 3(c)	2,2, 2
Apply some basic concepts of number theory to solve various problems.	L2, L3, L3	4(a), 4(b), 4(c)	2,2, 2
Analyze the syntax and semantics of sentential calculus (SC) and use the SC rules to test and justify the soundness of arguments and perform the SC derivations.	L2, L3, L3	5(a), 5(b), 5(c)	2,2, 2

\*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5), Creation (L6)

*Answer all five questions.*

*All questions carry equal marks. All bits of each question carry equal marks.*

Q1.

- Determine whether  $\neg p \rightarrow (q \rightarrow r)$  and  $q \rightarrow (p \vee r)$  are logically equivalent or not. 2
- Write the principal disjunctive normal form and principal conjunctive normal form of the following expression.  
 $Q \wedge (P \vee \neg Q)$  2
- Show that if  $n$  is an integer and  $3n + 2$  is odd, then  $n$  is odd; using a proof by contradiction. 2

Q2.

- Translate the statement into logical expression using predicates, quantifiers and logical connectives.  
'All your friends are perfect.' 2
- Use rules of inference to show that the hypotheses 'Randy works hard,' 'If Randy works hard, then he is a dull boy,' 'If Randy is a dull boy, then he will not get the job,' imply the conclusion 'Randy will not get the job.' 2
- Show that if  $n$  is an integer, then  $n^2 \geq n$  using a proof by cases. 2



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Q3.

- (a) Use the bubble sort algorithm to sort 6, 2, 3, 1, 5, 4 showing the lists obtained at each step. 2
- (b) Determine whether  $5 \log x$  is  $O(x)$ . 2
- (c) Show that  $x^2 + 1000$  is  $\Omega(x^2)$ . 2

Q4.

- (a) Express  $\gcd(124, 323)$  as a linear combination of 124 and 323. 2
- (b) Determine an inverse of 4 modulo 9. 2
- (c) Use the linear congruential generator  $x_{n+1} = (7x_n + 4) \pmod{9}$  with seed  $x_0 = 3$  to generate a sequence of pseudorandom numbers. 2

Q5.

- (a) Translate the argument into sentential calculus(SC)  
*'Part A has failed or Part B has failed.'*  
*'If the gadget passes test number one, then it is not the case that part B has failed.'*  
*'If the battery is dead, then the green indicator light is not on.'*  
 Therefore: *'The green indicator light is on only if the gadget does not pass test number one.'* 2
- (b) Show that the following set of sentences is satisfiable.  
 $\{P, (P \vee Q), (R \rightarrow \neg P)\}$ , where  $P, Q$  and  $R$  are atomic SC sentences. 2
- (c) Show that  $\neg(A \vee S) \rightarrow B$  is not a tautological consequence of  
 $\Gamma = \{(A \vee B) \leftrightarrow R, \neg(A \vee R)\}$ , where  $A, B, R$  and  $S$  are atomic SC sentences. 2

\*End of Questions\*