Reg. No. : [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Question Paper Code : J1505

M.Sc. DEGREE EXAMINATION, FEBRUARY/MARCH 2018.

First Semester

Computer Science

DCS 7105 – MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the difference between combinational logic and sequential logic?

2. Define Predicate calculus.

3. How many different permutations of $\{a, b, c, d, e, f, g\}$ end with a?

4. State about pigeonhole principle.

5. Define abelian group.

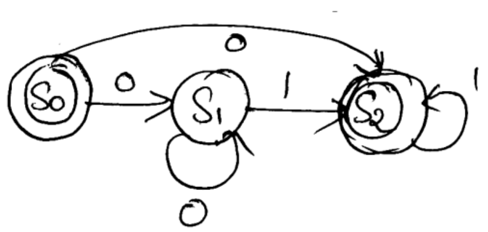
6. What is meant by ring in algebraic system?

7. Determine whether the posets $(\{1, 2, 3, 4, 5\}, |)$ and $(\{1,2,4,8,16\}, |)$ are lattices.

8. Give the definition of partial ordering.

9. Find a regular expression consisting of all strings over {a, b} starting with any number of a's, followed by one or more b's, followed by one or more a's, followed by a single b, followed by any number of a's, followed by b and ending in any string of a's and b's.

10. Find the language of the given NFA.



PART B — ($5 \times 13 = 65$ marks)

11. (a) (i) Express the following statements involving predicates in symbolic form.

(1) All students are clever

(2) Some students are not successful

(3) Every clever student is successful

(4) There are some successful students who are not clever. (8)

(ii) Show that $\neg(PV(\neg P \wedge Q))$ and $\neg P \wedge \neg Q$ are logically equivalent by developing a series of logical equivalence. (5)

Or

(b) (i) Explain the types of normal forms for propositional and predicate logic. (6)

(ii) Obtain the principal disjunction normal form for $(P \wedge Q) \vee (\neg P \wedge R) \vee (Q \wedge R)$ (7)

12. (a) (i) Solve the following using inclusion exclusion principle :

A total of 1232 students have taken a course in Spanish, 879 have taken a course in French and 114 have taken a course in Russian. Further, 103 have taken courses in both Spanish and French 23 have taken courses in both Spanish and Russian, and 14 have taken courses in both French and Russian. If 2092 students have taken at least one of Spanish, French and Russian, how many students have taken a course in all three languages? (7)

(ii) How many students must be in a class to guarantee that at least two students receive the same score on the final exam is graded on a scale from 0 to 100 points? (Use Pigenhole Principle) (6)

Or

(b) (i) Explain relation and its properties in detail. (6)

(ii) Determine whether the relation R on the set of all real numbers is reflexive, symmetric, anti symmetric. and/or transitive, where $(x, y) \in R$ if and only if (7)

(1) $x + y = 0$

(2) $x = 2y$

(3) $xy \geq 0$

13. (a) (i) Show that the set G={–1,1} is a group under usual multiplication. (6)

(ii) Show that every subgroup of cyclic group is cyclic. (7)

Or

(b) If S_3={1,2,3}, then show that (S_3,.) is a permutation group, where . denotes the composition of functions. (13)

14. (a) (i) Draw the Hassie diagram representing the partial ordering {(a,b) | a divides b} on {1,2,3,4,6,8,12}. (6)

(ii) In a Boolean algebra, show that $ab'+a'b=0$ If and only If a=b. (7)

Or

(b) (i) In a lattice, prove that $a \le b \Rightarrow a+b=a.$ (6)

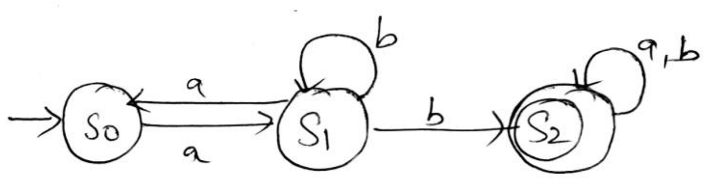
(ii) Show that complement of an element in a distributive lattice is unique. (7)

15. (a) (i) Explain in detail about context free grammar and languages. (6)

(ii) Construct a derivation tree for the word ababbbba using the grammar G, Where G consists of the production $\{S \to Abs, A \to aS, S \to ba, b \to a\}$. (7)

Or

(b) Discuss about the equivalence of deterministic and nondeterministic automata and find the equivalent DFA for the given NFA. (13)



PART C — (1 × 15 = 15 marks)

16. (a) State and prove Langrenge's theorem. (15)

Or

(b) (i) Use the method of generating function to solve the recurrence relation $a_n = 3\,a_{n-1} + 1$ for $n \geq 1, a_o = 1$. (10)

(ii) Show that the intersection of two subgroups of a group, G is also a subgroup of G. (5)

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Reg. No. : | | | | | | | | | | | | | |

Question Paper Code : BS2505

M.Sc. DEGREE EXAMINATION, AUGUST/SEPTEMBER 2017

First Semester

Computer Science

DCS 7105 — MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

(Regulations 2013)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the truth table of $\sim (P \rightarrow Q)$. .

2. Negate the statement: 4 is a prime number and 5 is not an even integer.

3. How many words of three distinct letters can be formed from the letters of the word LAND?

4. Solve the recurrence relation $a_r - 6a_{r-1} + 8a_{r-2} = 0$.

5. Find the inverse of $\sigma = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 6 & 4 & 5 & 2 & 3 & 1 \end{pmatrix}$, where σ is a permutation map.

6. Define cyclic group with an example.

7. Simplify the Boolean expression $x(x'+y)$.

8. Obtain Hasse Diagram of $(p(A), \leq)$, where $A = (a, b, c, d)$.

9. When are two finite state automata said to be equivalent?

10. Draw the state diagram of a FSA that accepts strings over (a, b) containing exactly one b.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Obtain the PCNF and PDNF of the formula $(P \to ((P \to Q) \wedge \sim (\sim Q \vee \sim P)))$. (6)

(ii) Define inconsistent premises. Show that the premises $E \to S, S \to H, A \to \sim H, E \wedge A$ are inconsistent. (7)

Or

(b) (i) Show that $R \to \sim Q, R \vee S, S \to \sim Q, P \to Q \Rightarrow \sim P$. (7)

(ii) By indirect method prove that $P \to R, Q \to S, P \vee Q \Rightarrow S \vee R$. (6)

12. (a) (i) There are 3 piles of identical red, blue and green balls, where each pile contains at least 10 balls. In how many ways can 10 balls be selected (1) if there is no restriction? (2) if at least one red ball must be selected? (3) if at least one red ball, at least 2 blue balls and at least 3 green balls must he selected? (7)

(ii) Find the number of non-negative integer solutions of the inequality $x_1 + x_2 + x_3 + x_4 + x_5 + x_6 < 10$. (6)

Or

(b) (i) Prove by mathematical induction, that (7)

$$1.2.3 + 2.3.4 + 3.4.5 + \cdots, + n(n+1)(n+2) = \frac{1}{4} n(n+1)(n+2)(n+3).$$

(ii) Solve the recurrence relation $a_r - 3a_{r-1} + 2a_{r-2} = 2^r$. (6)

13. (a) (i) Show that two cosets are either identical or disjoint. (6)

(ii) Show that if order of a group is prime, then it has no proper subgroups. (7)

Or

(b) State and Prove Lagrange's theorem. (13)

14. (a) (i) Let $A = \{1,2,3,5,6,15,30\}$. Show that divides is a partial ordering of A, and draw the Hasse Diagram. (7)

(ii) In any Boolean algebra, show that $ab' + a'b = 0$ *if and only if* $a = b$. (6)

Or

(b) (i) If R is the relation on the set of positive integers such that $(a,b) \in R$ if and only if $a^2 + b$ is even, then prove that R is an equivalence relation. (7)

(ii) Simplify the Boolean expression $a', b', c + a, b', c + a', b', c'$ using Boolean algebra identities. (6)

15. (a) (i) Construct and an FSA that accepts all strings over $\{a, b\}$ which begin with a and end with b. (6)

(ii) Design an NFA that accepts the non-null strings over $\{a, b\}$ starting with ab but not ending with ab. (7)

Or

(b) (i) Find the DFA equivalent to the NFA for which the state table is given in the following and s_2 is the accepting state. (7)

S \ I	f	
	a	b
s_0	$\{s_0, s_1\}$	s_2
s_1	s_0	s_1
s_2	s_1	$\{s_0, s_1\}$

(ii) Write a note an finite state automata. (6)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Obtain PDNF of $P \vee (\sim P \wedge \sim Q \wedge R)$ (8)

(ii) Obtain PCNF of $(\sim P \rightarrow R) \wedge (Q \rightarrow P)$. (7)

Or

(b) Write each of the following in symbolic from by assuming that the universe consists of literally everything. (15)

(i) All men are giants.

(ii) No men are giants

(iii) Some men are giants

(iv) Some men are not giants.

Reg. No. | | | | | | | | | | | | | |

Question Paper Code : KJ1505

M.Sc. DEGREE EXAMINATION, FEBRUARY/MARCH 2017.

First Semester

Computer Science

DCS 7105 – MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. State the modus ponens and modus tollens rules in predicate calculus.

2. Define the functionally complete set of connectives.

3. A child has four hats, three pairs of gloves and five pair of socks. Determine different possible triplets he can wear.

4. State the pigeonhole principle.

5. Justify: Every cyclic group is abelian.

6. State the identity law in a group.

7. Draw the Hasse diagram of lattices of D35.

8. Give an example of a Poset.

9. Design a NFA-E for the regular expression $r = 0^*12$.

10. Define the Derivation tree.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Construct the truth table for the following formulas

(1) $(\urcorner A) \vee B$

(2) $(A \rightarrow B) \rightarrow C$

(3) $((\urcorner A) \vee (\urcorner B)) \wedge C \Leftrightarrow \urcorner C$ (8)

(ii) Establish the validity of the following arguments using the rule of contradiction.

$[(p \rightarrow q) \wedge (\urcorner r \vee s) \wedge (p \vee r)] \rightarrow [\urcorner q \rightarrow s]$. (8)

Or

(b) (i) Test the validity of the arguments. Babies are illogical. No body who can tame a crocodile is despised. Illogical persons are despised. Therefore babies cannot tame crocodiles. (8)

(ii) Obtain the PCNF and PDNF of $(p \wedge q) \vee (\urcorner p \wedge q \wedge r)$. (8)

12. (a) (i) Find the number of solutions of

$$x_1 + x_2 + x_3 + ...x_8 = 72,\ x_1 > 2,\ x_2 > -1,\ x_3 > 3,\ x_4, x_5, x_6, x_7, x_8 > 0. \quad (8)$$

(ii) Find the number of integers between 1 to 300 that are not divisible by 2,3,5 and 7. (8)

Or

(b) (i) A coin is tossed 8 times. How many outcomes have

(1) Exactly 3 heads (2) At most 3 heads (3) an equal number of heads and tails. (8)

(ii) Solve the recurrence relation

$$a_n - 5a_{n-1} + 8a_{n-2} - 4a_{n-3} = 4^n. \quad (8)$$

13. (a) (i) Prove that subgroup of a cyclic group is cyclic. (8)

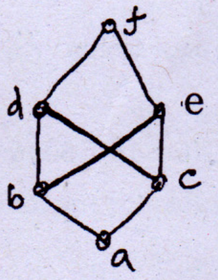
(ii) Derive the multiplication table for (S_3, O). (8)

Or

(b) (i) Show that every subgroup of an abelian group is normal. (8)

(ii) Let $H = \{0, 5, 10\}$ and $G = \{Z_{15}, +_{15}\}$. Find all right and left cosets of H in Z_{15}. (8)

14. (a) (i) Examine whether the poset $(L, \leq)$ given as follows form a lattice. (8)



(ii) Let $(L, \leq)$ be a lattice.

Then discuss the following property

(1) Isotonicity (2) Distributed inequality (3) Modular inequality. (8)

Or

(b) For all a, b in a Boolean algebra B, show that

(i) $(a+b)' = a'.b'$

(ii) $(a.b)' = a'+b'$

(iii) $(a+b).(b+c).(c+a) = (a.b)+(b.c)+(c.a)$. (16)

15. (a) (i) Prove that every regular set is accepted by a finite auto-mata. (8)

(ii) Construct a context free Grammar to generate the following language

$$L = \{a^n b^n \text{ or } a^{2n} b^n / n \geq 1\}.$$ (8)

Or

(b) (i) Construct a finite automata which accept the strings of length divisible by 3 over $\Sigma = \{0, 1\}$. (8)

(ii) Construct a DFA equivalent to $M = (\{q_0, q_1\}, \{0, 1\}, \delta_1, q_0\})$, where δ is given by the table

State Σ	0	1
q_0	q_0	q_1
q_1	q_1	$q_0\ q_1$

Reg. No. :

Question Paper Code : J1530

M.Sc. DEGREE EXAMINATION, AUGUST/SEPTEMBER 2016.

(From Academic Year – 2015 – New Question Paper Pattern)

First Semester

Computer Science

DCS 7105 — MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the negation of the statement "–2 is negative and 4 is odd"?

2. Given the truth values of P and Q as 'F' and those of R and S as 'T'. Find the truth value of $P \vee (Q \wedge R)$.

3. State the principle of Inclusion and Exclusion.

4. How many words of three distinct letters can be formed from the letters of the word NEST?

5. Define homomorphism.

6. Prove that the inverse of an element 'a' in a group G is unique.

7. Draw the Hasse diagram of the set of all divisors of 16.

8. What is meant by minterm and maxterm in a poset?

9. Define an ambiguous grammar.

10. Give the regular expression to denote the floating point constant in C programming language.

PART B — ($5 \times 13 = 65$ marks)

11. (a) (i) Show that $P \to (Q \to P)$ and $\rceil P \to (P \to Q)$ are logically equivalent. (6)

(ii) Demonstrate that S is a valid inference from the premises $P \to \rceil Q$, $Q \vee R, \rceil S \to P$ and $\rceil R$. (7)

Or

(b) (i) Obtain a DNF of $(Q \vee (P \wedge R)) \wedge \rceil((P \vee R) \wedge Q)$. (7)

(ii) Obtain a CNF of $P \to [(P \to Q) \wedge \rceil(Q \vee \rceil P)]$. (6)

12. (a) (i) Consider a set of integers from 1 to 200. Find how many of these numbers are divisible by 3 or 7 but not by 5. (6)

(ii) In how many ways can a committee of four ladies and five gents be chosen from 9 ladies and 15 gents, if a particular person A cannot take part if lady B is on the committee? (7)

Or

(b) (i) Prove by mathematical induction that, $2n + 1 \leq 2^n$ for $n \geq 3$. (7)

(ii) Find the generating function of the sequence $U_n = n$. (6)

13. (a) (i) Define a group. Prove that the addition modulo 5 is a group. (7)

(ii) Define field with example. (6)

Or

(b) State and prove Lagrange's theorem. (13)

14. (a) (i) If R is a relation defined on the set Z by a R b if $a - b$ is a non-negative even integer. Determine if R is a partial order relation. (7)

(ii) Find the values of Boolen function $f(x, y, z) = xy + z^1$. (6)

Or

(b) (i) $A = (1,2,3,6,12)$, R is from A to A, $a\,R\,b$ if a divides b. Draw Hasse diagram. (7)

(ii) In a distributive Lattice, prove that the following are equivalent :

$a * b \leq A \leq a\ b$. (6)

15. (a) (i) Show that the grammar G with production rules S-> aS / aSbS / € is ambiguous and find the unambiguous grammar. (7)

(ii) Describe the operations involved in Regular expression and the applications of Regular expressions. (6)

Or

(b) Construct a finite automata accepting all strings in {0, 1} * having even number of 0's. Also give its transition table and transition diagram. Show the sequence of state transitions for a sample input string of your choice. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Define PDNF and PCNF. Find the PDNF and PCNF of $P \rightarrow ((P \rightarrow Q) \wedge \urcorner(\urcorner Q \vee \urcorner P))$ without using truth table. (15)

Or

(b) Differentiate DFA and NFA. Construct NFA for the regular expression $O^i 1^j O^k / i, j, k \geq 0$. Find an equivalent DFA for the above and explain the conversion procedure. (15)

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Reg. No. : [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Question Paper Code : 80505

M.Sc. DEGREE EXAMINATION, AUGUST 2015.

First Semester

Computer Science

DCS 7105 — MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

(Regulations 2013)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. If either Jerry takes calculus or Ken takes sociology, then Larry will take English. Write the statement in symbolic form.

2. Write the dual of (a) $(P \wedge Q) \vee T$ (b) $\neg(P \vee Q) \wedge (P \vee \neg(Q \wedge \neg S))$.

3. Find the value of n in $p(n, 2) = 90$.

4. How does a programmer finds coding errors?

5. Define a cyclic group with example.

6. Define a homomorphism with example.

7. Show that in a lattice if $a \leq b \leq c$ then $a \oplus b = b * c$.

8. Define a Boolean algebra.

9. Define a finite state automation.

10. Give any two features of preprocessor.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Construct the truth table for $(p \to q) \leftrightarrow ((p \wedge q) \vee (\neg p \wedge \neg q))$. (8)

(ii) Show that $((P \vee \neg P) \to Q) \to ((P \vee \neg P) \to R) \Leftrightarrow (Q \to R)$. (8)

Or

(b) (i) Obtain disjunctive normal forms of $\neg(P \vee Q) \Leftrightarrow (P \wedge Q)$. (8)

(ii) Show that the formula $Q \vee (P \wedge \neg Q) \vee (\neg P \wedge \neg Q)$ is a tautology. (8)

12. (a) (i) Prove that for any $n \in Z^+$, $\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$. (8)

(ii) In how many ways can the 26 letters of the alphabet be permuted so that none of the patterns car, dog, pun or byte occurs. (8)

Or

(b) (i) Solve the recurrence relation $a_n = 5a_{n-1} + 6a_{n-2}$, $n \geq 2$ $a_0 = 1$ and $a_1 = 3$. (8)

(ii) Find the number of primes less than 100 using the principle of inclusion and exclusion. (8)

13. (a) (i) If H and K are normal subgroups of G prove that $H \cap K$ is a normal subgroup of G. (6)

(ii) State and prove Lagranges theorem. (10)

Or

(b) (i) Prove that N is a normal subgroup of a group G if and only if $gNg^{-1} = N$. (8)

(ii) Show that every group of prime order is cyclic. (8)

14. (a) (i) Let $(L, \leq)$ be a lattice, prove that for any $a, b, c \in L$ $a \oplus (b * c) \leq (a \oplus b) * (a \oplus c)$ and $a * (b \oplus c) \geq (a * b) \oplus (a * c)$. (8)

(ii) Prove that every chain is a distributive lattice. (8)

Or

(b) (i) Let $(L, *, \oplus)$ be a distributive lattice. Prove that for any $a, b, c \in L$. $[(a * b) = (a * c)] \wedge [(a \oplus b) = (a \oplus c)] \Rightarrow b = c$. (8)

(ii) Prove the De Morgan's laws in Boolean algebra. (8)

15. (a) (i) Construct a deterministic finite automata accepting the language over the alphabet $\{0, 1\}$ to the set of all strings with three consecutive 0's. (8)

(ii) Prove that the regular sets are closed under intersection. (8)

Or

(b) (i) Construct a CFG generating the set $\{a^n b^n c^m / n, m \geq 1\}$. (8)

(ii) Give context free grammar generating the set of all strings of balanced parentheses. (8)