

(b) An intelligence agency forms a code of two distinct digits selected from 0, 1, 2, ..., 9 such that the first digit of the code is nonzero and digit repetition is not allowed. The code, handwritten on a slip, can however potentially create confusion, when read upside down-for example, the code 91 may appear as 16. How many codes are there for which no such confusion can arise? [2]

4. (a) Explain the principle of mathematical induction. Consider the sequence  $a_0, a_1, a_2, \dots$  defined by  $a_0 = 1/4$  and  $a_{n+1} = 2 a_n (1 - a_n)$  for  $n \geq 0$ . A formula for the sequence  $a_n$  defined above, is

$$a_n = (1 - 1/2^{2^n}) / 2, \forall n \geq 0.$$

Prove that the recursive formula is true by using proof by mathematical induction. [5]

(b) Write the pseudocode for selection sort. Sort the following list of elements using selection sort.

29, 72, 98, 13, 87, 66, 52, 51, 36

What is the best case and worst case complexity of selection sort? Justify. [5]

-END-

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THIRD SEMESTER  
MID SEMESTER EXAMINATION

Roll No. ....  
**B.Tech. (IT)**  
(Sep-2018)

**IT205 DISCRETE STRUCTURES**

Time: 1 Hour 30 Minutes

Max. Marks: 25

**Note:** Answer all questions.  
Assume suitable missing data, if any.

1. Translate in two ways each of these statements into logical expressions using predicates, quantifiers, and logical connectives. First, let the domain consist of the students in your class and second, let it consists of all people.
  - (i) Someone in your class can speak Hindi.
  - (ii) Everyone in your class is friendly.
  - (iii) There is a person in your class who was not born in California.
  - (iv) A student in your class has been in a movie.
  - (v) No student in your class has taken a course in logic programming.

[5]
2. (a) Using rules of inference, show that the premises  $\sim(r \vee s), \sim p \rightarrow s, p \rightarrow q$  leads to the conclusion  $q$ .

[3]

(b) Use proof by contradiction to prove that cube root of 2 is irrational.

[3]
3. (a) Explain the principle of inclusion and exclusion. Give a formula for number of elements in the union of four sets.

[2]

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