BRAC University

CSE230 : Discrete Mathematics

Duration : 1 hour 15 minutes (4:45 pm - 6:00 pm)

Total Marks : 50 Set: B

***[Answer any 5 out of 6 questions. Answer all the sub-parts of a question together. Please start each question in a new page]***

| **Student Name:** | **Student ID:** |
| --- | --- |

**Q01: [CO2] [10 Marks]**

1. Draw a Venn diagram using 3 sets Q, T and P. None of these 3 sets are pairwise disjoint. Moreover, . How many disjoint regions are there? Indicate which regions fall under . **[1+1=2 marks]**
2. Find the domain of . Show the domain in a number line. **[4 marks]**
3. Find the range of . What should be the domain of g(x)? **[3+1=4 marks]**

**Q02: [CO2] [10 Marks]**

A,B,C,D,E,F,G,H and I are nine students of CSE230 Fall 2022. They want to take pictures.

1. In how many ways can they stand in a straight line to take the picture keeping **F** right in the middle of the picture? **[2 marks]**
2. Now consider B,C, and D are close friends and they want to stay together in the group picture. How many ways can they take pictures keeping the “close” friends together? **[4 marks]**
3. Well, D has a “thing” for H. So he(D) wants to stay beside her(H). But he also wants to stay with his friends(B and C). For example, A**BCD**FGE**H**I is not allowed as D is not beside H although BCD are together, but A**CBDH**EFIG is allowed as D is with his friends and beside H too. Another allowed arrangement can be A**HDCB**FEGI. In how many ways can they stand for taking the picture keeping all these scenarios into consideration? **[4 marks]**

**Q03: [CO1] [10 Marks]**

1. How many arrangements of the word “**tictactoe**” are possible so that no two vowels are side-by-side? How many of them start and end with the same letter? **[3+3=6 marks]**
2. Adnan and Binti are playing a game in which Binti chooses k numbers from the set {2,...,20}. If Adnan can find 2 numbers from Binti’s chosen numbers whose sum is divisible by 10, then Adnan wins. What is the minimum value of k so that Adnan always wins? **[2 marks]**
3. In how many ways can you arrange the letters of the word “**ceremony**” so that y always comes after the e’s? For example, “**e**rm**e**no**y**c” is acceptable, whereas “**ye**rm**e**noc” and “r**e**m**y**onc**e**” are not. **[2 marks]**

**Q04: [CO3] [10 Marks]**

Read the following equations.

1. , a is an integer and
2. , n is a non-negative integer.

Now, answer the following questions.

1. Find out all the possible values of a from the equation (1). **[2 marks]**
2. If , show that, the -th term in the expansion of is a constant.

[Use value of a from eq. No.1] **[4 marks]**

1. If , find out the coefficient of in the expansion of

[Use value of a from eq. No.1] **[4 marks]**

**Q05: [CO4] [10 Marks]**

A deck of DIEZ Cards has 4 different colors which are Red, Green, Yellow and Blue. Each color has 1 Wild Card, 1 Reverse Card, 1 Block Card and 7 Normal Cards numbered from 1-7.

1. Find the probability of picking a Reverse Card from the deck. **[2 marks]**
2. If 3 cards are picked at random from the deck, what is the probability of picking at most 2 Wild cards? **[4 marks]**
3. Now, imagine one card is lost from the deck at random. If we pick a card from the deck, what is the probability of that card being a Block Card? **[4 marks]**

**Q06: [CO4] [10 Marks]**

The Graduate Record Examinations Test (GRE) is a requirement for all applicants of Msc Programs.

Suppose that a survey of GRE students reveals that among GRE scorers above 310, 52% took Magoosh (An Online Education Company) paid subscription, whereas among GRE scorers of less than 310 only 23% took the subscription. An applicant thinks that in order to get into a certain university he needs more than 310. The chance of obtaining more than 310 is

1. Suppose . Given that he took a Magoosh subscription, What is the probability of getting less than 310? **[7 marks]**
2. If the probability of getting more than 310 given that he has taken the Magoosh Subscription is 40%. Then what is ? **[3 marks]**