IŞIK UNIVERSITY, MATH 230 MIDTERM EXAM I

Q1 │	Q2 │	Student ID:	Row No:
Q3 │	**Q4 │**		
Last Name:		**First Name:**	

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1. (10 points) Determine whether the following statements are True or False. Circle **T** or **F**. No explanation is required. Let A, B, and A_i denote events in a sample space S and let $\mathbb{P}(.)$ denote a probability measure on S. (*Note: A statement is assumed to be true if it is true* **in any possible case**, *and it is assumed to be false if it fails in at least one case.*):

    i.   If A and B are mutually exclusive then $\mathbb{P}(A \cup B|F) = \mathbb{P}(A|F) + \mathbb{P}(B|F)$ *T F*

    ii.   If $\mathbb{P}(A) = 0.7$ and $\mathbb{P}(B) = 0.8$ then $\mathbb{P}(A \cap B) \geq 0.5$.   *T F*

    iii. $\mathbb{P}(A|B^c) = 1 - \mathbb{P}(A|B)$.   *T F*

    iv. $\mathbb{P}(A^c|B) = 1 - \mathbb{P}(A|B)$.   *T F*

    v.   If $\mathbb{P}(A|B) = \mathbb{P}(B|A)$ then A and B are equally likely events   *T F*

    vi.   If A and B are independent, then $\mathbb{P}(A|B) = \mathbb{P}(A|B^c)$.   *T F*

    vii.   If $\mathbb{P}(A) = (\mathbb{P}(A))^2$ then A is independent of A.   *T F*

    viii.   The sum of all coefficients in the expansion of $(x + y)^{10}$ is 2^{10}.   *T F*

    ix.   The coefficient of x^2y^3z in the expansion of $(x + y + z)^6$ is 60.   *T F*

    x. $\mathbb{P}((A \cup B)^c) = \mathbb{P}(A^c) + \mathbb{P}(B^c) + \mathbb{P}(A \cap B) - 1$ *T F*

2. (15 points) Suppose the events A, B and C are independent, and they have probabilities $\mathbb{P}(A) = 0.1$, $\mathbb{P}(B) = 0.2$ and $\mathbb{P}(A) = 0.3$.What is the probability

$$\mathbb{P}(A \cup B \cup C) = ?$$

3. (15 points) If $\mathbb{P}(A|F) = 0.7$, $\mathbb{P}(B|F) = 0.4$ and $\mathbb{P}(A^c \cap B^c|F) = 0.1$ then find $\mathbb{P}(A \cup B^c|F)$. (Use proper mathematical forms to receive full credit. Do not just show on Venn diagrams.)

4. (15 points) An urn contains 3 white and 7 black balls. A fair die is rolled and that number of balls is randomly chosen from the urn. What is the probability that the die landed on 3 given that all the balls selected are white?

5. (15 points)

    i. A,B,C,D,E and F are six students. In how many ways can they be seated if A and B must **not** sit next to each other ?

    ii. A password consists of 6 distinct characters, at least one of which must be a digit (from 0 to 9) and at least one of which must be one of the following special characters: #,*,&. Assume that the alphabet includes 26 letters. How many passwords are possible ?

    ii. If we have 13 servers at Company Inc. and we want to assign 6 servers to data center A, 4 to data center B, and 3 to data center C, how many possible arrangements are there?

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6. (15 points) We have 100 circuits of which 20 are known to be defective. A random sample of four circuits is selected without replacement. What is the probability that the sample will contain no more than two defective units?

7. (15 points)Suppose that two factories supply light bulbs to the market. Factory X's bulbs work for over 5000 hours in 99% of cases, whereas factory Y's bulbs work for over 5000 hours in 95% of cases. It is known that factory X supplies 60% of the total bulbs available. What is the chance that a purchased bulb will work for longer than 5000 hours? (*Solve the question using proper tools of conditional probability. Answers without conditional probability will not receive credit.*)