IŞIK UNIVERSITY, MATH 230 MIDTERM EXAM

I pledge my honour that I have not violated the honour code during this examination.				
Bu sınavda onur yasamızı ihlal etmediğime				
şerefim üzerine yemin ederim.				
Q3 First Name: Last Name: First Name: I pledge my honour that I have not violated the honour code during this examination. Signature : Bu sınavda onur yasamızı ihlal etmediğime şerefim üzerine yemin ederim. Signature :				

- 1. (18 points)
 - i. A group of 12 friends decided to go to the dinner. But they have to drive to the restaurant and there are 4 available cars. If they decide to use all of the cars and distribute themselves to the cars equally, in how many ways can they arrange this distribution?
 - ii. When these friends arrive at the restaurant, they decide to order some food to share. In the menu, there are 10 starters, 8 main dishes and 6 deserts. If they will order 5 different items from each group, in how many ways can they order food?
 - iii. What if they can order the same item more than once, and they will order 5 items (not necessarily different) from each group, in how many ways can they order food?

- 2. (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 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.):
 - If A and B are mutually exclusive then $\mathbb{P}(A \cup B|F) = \mathbb{P}(A|F) + \mathbb{P}(B|F)$ i.TFIf $\mathbb{P}(A) = 0$ and $B \subseteq A$ then $\mathbb{P}(B)$ ii.TF $\mathbb{P}(A|B^c) = 1 - \mathbb{P}(A|B).$ iii.TF $\mathbb{P}(A^c|B) = 1 - \mathbb{P}(A|B)$ TFiv. CDF is a decreasing function. TFv.vi.If A and B are independent, then $\mathbb{P}(A|B) = \mathbb{P}(A|B^c)$. TFvii. Variance can be a negative number. TFThe sum of all coefficients in the expansion of $(x + y)^{10}$ is 2^{10} . viii. TFThe coefficient of x^3yz^5 in the expansion of $(x + y + z)^9$ is 72. TFix. If $p(\cdot)$ is a PMF, then p(x) < 0 is possible for some x. TFx.

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- 3. (20 points) An exam will be given in rooms A, B, C and D. There are 10 men and 20 women in room A, 15 men and 20 women in room B, no men and 10 women in room C, and 10 men and no women in room D. One of th exam rooms is selected at random. Let X be the random variable denoting the number of women in the selected room.
 - i. Write the probability mass function (PMF) of X.

- ii. What is the expected number of women in the selected room?
- iii. What is the standard deviation of number of women in the selected room?

iv. Find the probability $\mathbb{P}(\ln(X) \ge 0)$.

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Last Name:		First Name:	

- 4. (18 points) In a biochemical laboratory scientists find out that if a rat carries the antibody A, then it also carries the antibody B with probability 2/5. If a rat does not carry the antibody A, then it does not carry the antibody B with probability 4/5. Half of the rat population in the laboratory carry the antibody A.
 - i. Calculate the probability that a rat carries the antibody A given that it carries the antibody B.

ii. Calculate the probability that a rat does not carry the antibody A given that it does not carry the antibody B.

- 5. (18 points) I have 8 keys. They all look the same. Only one of them opens my door. Calculate the probability that I open the door after at most 3 trials for the following two cases:
 - i. I put all the keys in a box and pick one of them and try, if it does not work, I put the key back into the box (due to stupidity) and try again and carry on this way.



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6. (16 points) A dresser drawer contains one pair of socks with each of the following colors: blue, red, white. Each pair is folded together in a matching set. You reach into the sock drawer and choose a pair of socks without looking. You replace this pair and then choose another pair of socks. Are the events that the first pair is red and the second pair is blue independent? State your reason properly in probabilistic language.