

Dept. of Computer Science and Engineering, National Sun Yat-sen Univ.
Second Semester of 2018 PhD Qualifying Exam

Subject : Probability

1. (20%) Let A , B , and C be three events.
 - a. (10%) Prove that $P(AB) \geq P(A) + P(B) - 1$
 - b. (10%) Show that exactly two of these three events will occur with probability $P(AB) + P(AC) + P(BC) - 3P(ABC)$
2. (20%) A newly married couple decides to continue having children until they have one of each sex. If the events of having a boy and a girl are independent and equiprobable, how many children should this couple expect?

3. (20%) Suppose that the loss in a certain investment, in thousands of dollars, is a continuous random variable X that has a density function of the form

$$f(x) = \begin{cases} k(2x - 3x^2) & -1 < x < 0 \\ 0 & \text{elsewhere} \end{cases}.$$

- a) (10%) Calculate the value of k
 - b) (10%) Find the probability that the loss is at most \$500.
4. (20%) A small college has 90 male and 30 female professors. An ad hoc committee of five is selected at random to write the vision and mission of the college. Let X and Y be the number of men and women on this committee, respectively.
 - a) (10%) Find the joint probability function of X and Y .
 - b) (10%) Find p_x and p_y the marginal probability function of X and Y .
5. (20%) A blind will fit Myra's bedroom's window if its width is between 41.5 and 42.5 inches. Myra buys a blind from a store that has 30 such blinds. What can be said about the probability that it fits her window if the average of the widths of blinds is 42 inches with standard deviation 0.25?