

**國立中山大學資訊工程學系**  
**105 學年度第 2 學期博士班資格考試**

科目：機率學

1. The following data on oxygen consumption (ml/kg/min) for a sample of ten fighters performing a fire-suppression simulation:  
29.5 49.3 30.6 28.2 28.0 26.3 33.9 29.4 23.5 31.6
  - (a) The sample range
  - (b) The sample variance  $s^2$
  - (c) The sample standard deviation
2. A chain of video stores sells four brands of DVDs. Of its DVD sales, 50% are brand 1, 30% are brand 2, and 20% are brand 3. It is known 25% of brand 1's DVDs require warranty repair work, whereas the corresponding percentages for brands 2 and 3 are 20% and 10%, respectively.
  - (a) What is the probability that a randomly selected purchaser has bought a brand 1 DVD that will need repair while under warranty?
  - (b) What is the probability that a randomly selected purchaser has a DVD that will need repair while under warranty?
  - (c) If a customer returns to the store with a VCR that needs warranty repair work, what is the probability that is a brand 1 DVD? A brand 2 DVD? A brand 3 DVD?
3. Prove that if A and B are independent, so are the following pairs of events: (1) A' and B, (2) A and B', and (3) A' and B'.
4. Suppose that the number of drivers who travel between a particular origin and destination during a designated time has a Poisson distribution with parameter  $\lambda=20$ . What is the probability that the number of drivers will
  - (a) Be at most 10?
  - (b) Exceed 20?
  - (c) Be between 10 and 20, inclusively? Be strictly between 10 and 20?
  - (d) Be within two standard deviations of the mean value?
5. Each front tire on a particular type of vehicle is supposed to be filled to a pressure of 26 psi. Suppose the actual air pressure in each tire is a random variable-X for the right tire and Y for the left tire, with joint pdf  $f(x, y) = k(x^2+y^2)$ ,  $20 \leq x \leq 30$  and  $20 \leq y \leq 30$ , and = 0 otherwise.
  - (1) What is the value of k?
  - (2) What is the probability that both tires are underfilled?
  - (3) What is the probability that difference in air pressure between two tires is at most 2 psi?
  - (4) Determine the (marginal) distribution of air pressure in the right tire alone.
  - (5) Are X and Y independent random variables?
  - (6) Compute the covariance between X and Y.
  - (7) Compute the correlation coefficient  $\rho$  for this X and Y.

