

國立台灣科技大學九十七學年度碩博士在職專班招生試題

系所組別：管理研究所EDBA博士在職專班甲組、乙組、丙組、丁組

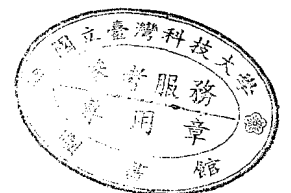
科目：統計學

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## 統計學

共七題，總計 100 分。依序作答。

1. (10%) Illustrate by concise examples (no more than 30 words for each example, indicating that I will only read the first 30 words for each example and ignore the rest) the *differences* between *probability* and *statistics*.
2. (10%) A bag contains one black and two white balls. Draw one by one with replacement. Keep drawing until two black and one white balls appear. Let  $X$  denote the total number of draws required.
  - (a) If two black balls appear in the first two draws, what is the expected value of  $X$ ?
  - (b) What is the expected value of  $X$ ? (Hint: use part (a) as a clue.)
3. (10%) When using *sample mean*  $\bar{X}$  to estimate the *population mean*  $\mu$ , why is it important to estimate the standard deviation of  $\bar{X}$ ? Your answer should be specific and concise (no more than 30 words, indicating that I will only read the first 30 words and ignore the rest).
4. (20%) A quality control engineer tries to perform a hypothesis testing on the defective rate  $p$  of a production line by sampling. The engineer stops sampling until he observes the first defective product. Let  $X$  denote the total number of products the engineer samples. The engineer wants to test the hypothesis  $H_0 : p \leq 10\%$  against  $H_1 : p > 10\%$ .
  - (a) What is the probability distribution of  $X$ ?
  - (b) Should the *rejection region* look like  $\{X \leq k\}$  or  $\{X \geq k\}$  for some  $k$ ? Why?
  - (c) If use  $k = 2$  for the answer in part (b), what is the *type I error rate*?
  - (d) If use  $k = 2$  for the answer in part (b), what is the *power* of the test for  $p = 20\%$ .



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5. (15%) A department store sells from 0 to 4 refrigerators each week. Based on the past experience, the following probabilities are assigned to sales of zero, one, two, three and four refrigerators:

$$P(0) = 0.08$$

$$P(1) = 0.18$$

$$P(2) = 0.32$$

$$P(3) = 0.30$$

$$P(4) = 0.12$$

- (a) Are these valid probability assignments? Why or why not?
- (b) Let  $A$  be the event that two or fewer are sold in one week. Find  $P(A)$ .
- (c) Let  $B$  be the event that four or more are sold in one week. Find  $P(B)$ .
6. (15%) The random variable  $X$  is known to be uniformly distributed between 1.0 and 1.5.
- (a) Find  $P(X = 1.25)$ .
- (b) Find  $P(1.0 \leq X \leq 1.25)$ .
- (c) Find  $P(1.2 < X < 1.5)$ .
7. (20%) The high way patrol maintains records showing that the time between an accident report being received and an officer arriving at the accident scene. A simple random sample of ten records shows the following times in minutes:  
12.6 3.4 4.8 5.0 6.8 2.3 3.6 8.1 2.5 10.3.
- (a) What is the point estimate of the population mean time between accident report and officer arrival?
- (b) What is the point estimate of the population standard deviation of time between accident report and officer arrival?

