

Statistics 151 Practice Midterm 3 Solutions – Multiple Choice + Written (50 minutes)

Instructions:

1. This is a closed book exam.
2. You may use the STAT 151 formula sheets and tables provided and a NON-PROGRAMMABLE calculator only.
3. You have 50 minutes to complete the exam.
4. The exam is out of a total of 27 marks (15 multiple choice and two long answer problems worth 6 marks each).
5. Show all your work for the long answer section to receive full credit.
6. Topics covered: Chapters 1 – 7 in Agresti/Franklin 2.

Multiple Choice (15 questions)

1. Suppose that A and B are two independent events with $P(A) = .2$ and $P(B) = .4$. $P(A$ and not $B)$ is
A) **0.12**. B) 0.60. C) 0.08. D) 0.52.
2. Event A has probability 0.4. Event B has probability 0.5. If A and B are disjoint, then the probability that both events occur is
A) 0.1. **B) 0.0**. C) 0.9. D) 0.2.

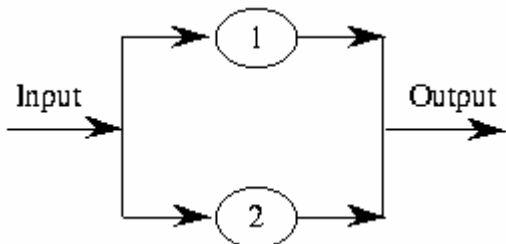
Use the following to answer question 3:

The temperature at any random location in a kiln used in the manufacture of bricks is normally distributed with a mean of 1000 and a standard deviation of 50°F.

3. If bricks are fired at a temperature above 1125°F, they will crack and must be disposed of. If the bricks are placed randomly throughout the kiln, the proportion of bricks that crack during the firing process is closest to
A) **0.62%**. B) 2.28%. C) 47.72%. D) 49.38%.

Use the following to answer question 4:

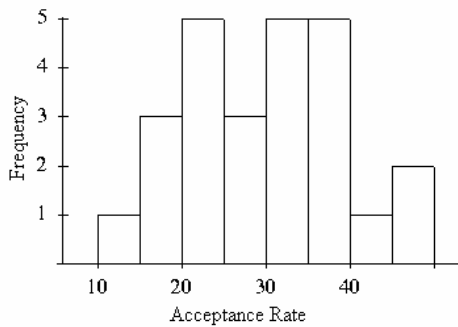
A system has two components that operate in parallel, as shown in the diagram below. Because the components operate in parallel, at least one of the components must function properly if the system is to function properly. The probabilities of *failures* for the components 1 and 2 during one period of operation are .20 and .03, respectively. Let F denote the event that the component 1 *fails* during one period of operation and G denote the event that component 2 *fails* during one period of operation. The component failures are independent.



4. The event corresponding to the above system failing during one period of operation is
A) F and G . B) F or G . C) not F or not G . D) not F and not G .
5. A Senator wants to know what the voters of his state think of proposed legislation on gun control. He mails a questionnaire on the subject to an SRS of 2500 voters in his state. His staff reports that 448 questionnaires have been returned, of which 343 support the legislation. The population is
 A) the 2500 voters receiving the questionnaire.
B) the voters in his state.
 C) the 343 letters supporting the legislation.
 D) the 448 letters received.

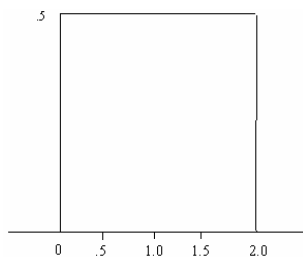
Use the following to answer question 6:

The following histogram represents the distribution of acceptance rates (percent accepted) among 25 business schools in 1997. In each class interval, the left endpoint is included but not the right.



6. What percent of the schools have an acceptance rate of under 20%?
 A) 4% **B) 16%** C) 12% D) 3%
7. A market research company wishes to find out whether the population of students at a university prefers brand A or brand B of instant coffee. A random sample of students is selected, and each one is asked to try brand A first and then brand B (or vice versa, with the order determined at random). They then indicate which brand they prefer. This is an example of
 A) an observational study.
 B) stratified sampling design.
 C) block design.
D) an experiment.
8. In a certain town, 50% of the households own a cellular phone, 40% own a pager, and 20% own both a cellular phone and a pager. The proportion of households that own neither a cellular phone nor a pager is
 A) 90%. B) 70%. C) 10%. **D) 30%.**

Use the following to answer question 9:



9. For the density curve above, what is the probability that an observation lies between 0.5 and **1.00**?
Note: The question in the original has a typo.
 A) 0.50 B) 0.70 C) **0.25** D) 0.35
10. An event A will occur with probability 0.5. An event B will occur with probability 0.6. The probability that both A and B will occur is 0.1. We may conclude
 A) that events A and B are independent. C) **that either A or B always occurs.**
 B) that events A and B are disjoint. D) None of the above.
11. A phone-in poll conducted by a newspaper reported that 73% of those who called in liked business tycoon Donald Trump. The true percentage of American citizens who like Donald Trump is a
 A) population. B) sample. C) **parameter.** D) statistic.
12. A set of data has a mean that is much larger than the median. Which of the following statements is most consistent with this information?
 A) The data set probably has a few low outliers.
B) A histogram of the data is skewed right.
 C) A histogram of the data is skewed left.
 D) A histogram of the data is symmetric.
13. If the individual outcomes of a phenomenon are uncertain, but there is nonetheless a regular distribution of outcomes in a large number of repetitions, we say the phenomenon is
A) random. B) predictable. C) deterministic. D) None of the above.
14. An event A will occur with probability 0.5. An event B will occur with probability 0.6. The probability that both A and B will occur is 0.1. The conditional probability of A given B
 A) is 0.833.
 B) Cannot be determined from the information given.
 C) is 0.200.
D) is 0.167.

15. In a large population of adults, the mean IQ is 112 with a standard deviation of 20. Suppose 200 adults are randomly selected for a market research campaign. The distribution of the sample mean IQ is
- A) **approximately normal, mean 112 , standard deviation 1.414.**
 - B) exactly normal, mean 112, standard deviation 20.
 - C) approximately normal, mean 112, standard deviation 20.
 - D) approximately normal, mean 112, standard deviation 0.1.

Long Answer

Question 1: The scores on a university examination are normally distributed with a mean of 62 and a standard deviation of 11.

$$\text{Let } X = \text{score. } X \sim N(\mu = 62, \sigma = 11)$$

- a. (3 marks) If the bottom 5% of students will fail the course, what is the lowest mark that a student can have and still be awarded passing grade?

$$\text{We want } x, \text{ so that } P(X < x) = 0.05.$$

$$\text{From } Z \sim N(0,1),$$

$$P(Z < z) = 0.05 \Rightarrow z = -1.645.$$

$$\text{Since } Z = \frac{(X - \mu)}{\sigma} \Rightarrow X = Z\sigma + \mu$$

$$\therefore x = -1.645(11) + 62 = 43.905.$$

You would need at least 43.905 to pass.

- b. (3 marks) Suppose seven students are randomly selected. What is the probability their average will exceed 62?

$$\text{From the C.L.T., } \bar{X} \sim N(\mu_{\bar{X}} = 62, \sigma_{\bar{X}} = 11/\sqrt{7} = 4.16)$$

$$\therefore P(\bar{X} > 62) = 0.5.$$

Question 2: A sample space consists of 5 outcomes E_1, E_2, \dots, E_5 .

- a. (3 marks) If $P(E_1) = P(E_2) = 0.15$, $P(E_3) = 0.4$, and $P(E_4) = 2P(E_5)$, find the probabilities of E_4 and E_5 .

Solution: $P(E_4) = 0.2$, $P(E_5) = 0.1$.

- b. (3 marks) If $P(E_1) = 3P(E_2) = 0.3$, find the probabilities of $P(E_3)$, $P(E_4)$ and $P(E_5)$ provided that $P(E_3) = P(E_4) = P(E_5) = p$.

Solution: $p=0.2$