

## Exam *Statistics*

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| <b>Problem 1</b> | <b>20 points</b> |
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The following table gives the frequency distribution of ages for all 50 employees of a company:

| Age (from ... till under...) | Number of Employees |
|------------------------------|---------------------|
| 18 - 30                      | 12                  |
| 30 - 43                      | 19                  |
| 43 - 56                      | 14                  |
| 56 - 69                      | 5                   |

1. What percentage of the employees is younger than 29 or at least 58 years old?
2. Calculate the average age of the employees. How representative is this average?

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| <b>Problem 2</b> | <b>20 points</b> |
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The following table shows the relation between the price ( $p$ ) of a product and the quantity demanded ( $q$ ):

| Demand | Price   |
|--------|---------|
| 1      | 3115.20 |
| 2      | 2426.12 |
| 3      | 1889.46 |
| 4      | 1471.51 |
| 5      | 1146.01 |
| 6      | 892.52  |
| 7      | 695.09  |
| 8      | 541.34  |

1. Approximate the data by a demand function of the form

$$p^* = a_0 e^{a_1 q}$$

2. Calculate the price for the demand being equal to 10 units

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| <b>Problem 3</b> | <b>20 points</b> |
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The average stock price for companies making up the S&P500 is \$30, and the standard deviation is \$8.2 (*Business Week*, Special Annual Issue. Spring 2003). Assume the stock prices are normally distributed.

1. What is the probability a company will have a stock price of at least \$40?
2. What is the probability the company will have a stock price no higher than \$20?
3. How high does a stock price have to be to put a company in the top 10%?

**Choose exactly two of the following four problems. Strike out the ones that you have not chosen. Combinations are not allowed**

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| <b>Problem 4</b> | <b>20 points</b> |
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A company advertises a job for graduates in three newspapers:  $N_1, N_2,$  and  $N_3$ . It is known that these papers attract undergraduate readership in the proportions 2: 3: 1. The probabilities that a graduate sees and replies to the job advertisement in these papers are 0.002, 0.001 and 0.005 respectively. Assume that the undergraduate sees only one job advertisement.

1. If the company receives only one reply to its advertisements, calculate the probability that the applicant has seen the job advertised in place
  - i)  $N_1,$
  - ii)  $N_2,$
  - iii)  $N_3.$
  
2. If the company receives two replies, what is the probability that both applicants saw the job advertised in paper  $N_1$  ?

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| <b>Problem 5</b> | <b>20 points</b> |
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The American Housing Survey reported the following data on the number of bedrooms [1000s] in owner-occupied houses in central cities (*www.census.gov*, March 31, 2003)

|          |    |     |      |      |           |
|----------|----|-----|------|------|-----------|
| Bedrooms | 0  | 1   | 2    | 3    | 4 or more |
| Number   | 23 | 541 | 3832 | 8690 | 3783      |

Denote by  $X$  the number of bedrooms in owner-occupied houses in central cities.

1. Construct the distribution function (with probabilities rounded to four decimal places). Calculate and interpret  $F(2)$
  
2. Find and interpret the expected value and standard deviation of  $X$  .

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| <b>Problem 6</b> | <b>20 points</b> |
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The label on a bottle of liquid detergent shows contents to be 12 ounces per bottle. The production operation fills the bottle uniformly according to the following probability density function:

$$f(x) = \begin{cases} 8 & \text{for } 11.975 \leq x \leq 12.100 \\ 0 & \text{elsewhere} \end{cases}$$

1. What is the probability that a bottle will be filled with between 12 and 12.05 ounces?
2. What is the probability that a bottle will be filled with 12.02 or more ounces?
3. Quality control accepts a bottle that is filled to within 0.02 ounces of the number of ounces shown on the container label. What is the probability that a bottle of this liquid detergent will fail to meet the quality control standard?

**Problem 7****20 points**

A company has five applications for two positions: two women and three men. Suppose that the five applicants are equally qualified and that no preference is given for choosing either gender. Let  $X$  be the number of women chosen to fill the two positions.

1. Find the probability function for  $X$  .
2. Construct the distribution function.
3. Calculate the expected value and the standard deviation of the distribution.