Read the following **instructions** very carefully before you start the test.

- This test is **closed** book and notes; one summary sheet is allowed.
- Show all your work **clearly** and **circle** your answers.
- **No** credit will be given to answers without proper work shown or without being circled.
- You may use the back of the test if you need more space and indicate so.
- Each question is worth **5** points, otherwise the value is specified.
- Turn in your summary sheet with your name on it along with your exam.
- It is your responsibility to check that your copy of the test consists of **6** pages including the cover page.
- Make sure to put your **name** or initials on each and every page.

**GOOD LUCK**

Page 1: Cover page

Page 2:

Page 3:

Page 4:

Page 5:

Page 6:

Total: out of **102**
1. The book values (in dollars, i.e. net worth divided by number of outstanding shares) for a ransom sample of 50 stocks from New Stock Exchange are collected and summarized using MS Excel in the following page

a. Circle the correct word on each line below. (1 pt. each)
   The above data are qualitative/quantitative, and can be considered as continuous/discrete. The level of measurement of the above data is interval/nominal/ordinal/ratio scale.

b. Find the mean of the book values of the stocks. (2 pts.)

c. Find the standard deviation of the book values of the stocks, and explain what the standard deviation measures.

d. Find the coefficient of variation (CV) of the book values of the stocks, and explain what the CV measures.

e. If the data were census data, what would be the variance of the book values of the stocks? (4 pts.)

f. Find the inter-quartile range of the book values of the stocks.

g. Is the distribution of the book values of the stocks symmetric, skewed to the right, or skewed to the left? Justify your answer using at least two pieces of evidence.
MS Excel output for questions 1-a) through 1-g).

Data | Summary Statistics
---|---
| Mean 0.522161911
| Standard Error 0.522161911
| Median 9
| Mode 8
| Standard Deviation
| Sample Variance 13.63265306
| Kurtosis 2.280228807
| Skewness 1.3055371
| Range 19
| Minimum 4
| Maximum 23
| Sum 490
| Count 50

2. The following data give the annual earnings (rounded to thousands of dollars) of 6 households selected from a “small-town U.S.A.”.

24, 35, 35, 33, 70, 63.

a. Find the mean of the annual earnings and explain in what sense the means is a measure of central tendency.

b. Find the standard deviation of the annual earnings.

c. Find the median of the annual earnings and explain what the median measures.

d. Find the mean absolute deviation (MAD) and explain what the measure measures. (7 pts.)
3. All employees of a company are asked whether they possess a credit card or a debit card. The following table contains the summary of the responses of the employees.

<table>
<thead>
<tr>
<th>Credit Card</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>Debit Card</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>120</td>
<td>10</td>
</tr>
</tbody>
</table>

a. Find the probability that a randomly selected employee possesses neither a credit card nor a debit card. (4 pts.)

b. Suppose that a randomly selected employee possesses a debit card. Find the probability that this employee possesses a credit card.

4. The following are the monthly rate of changes in the Dow Jones Industrial Average (DJIA) over the past five months this year. Calculate the average monthly rate of changes in DJIA over this time period.

<table>
<thead>
<tr>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.25%</td>
<td>-2.13%</td>
<td>3.89%</td>
<td>-2.88%</td>
<td>1.63%</td>
</tr>
</tbody>
</table>

5. At a company, 28% of the employees are females, 20% of the employees are managers, and 4% of the employees are female managers. Find the probability that a randomly selected employee of the company is either a female or a manager. (4 pts.)
6. The assets of 500 U.S. companies as of the last day of 1993 had a mean of $12,270 million and a standard deviation of $2,780 million.

   a. Suppose a company has an asset of $12,660 million. Find the standardized score of the asset value of this company. (3 pts.)

   b. Find an interval around the mean that contains at least 80% of the assets of these 500 companies as of the last day of 1993.

7. Of the movies produced in the U.S., 60% are profitable. Of the movies that are profitable, 70% receive a “Two Thumbs Up” rating by movie critics Siskel and Ebert while only 20% of non-profitable movies receive a “Two Thumbs Up” rating.

   a. What is the probability that a randomly selected movie receives a “Two Thumbs Up” rating and profitable?

   b. What is the probability that a randomly selected movie receives a “Two Thumbs Up”?

   c. A randomly selected movie receives a “Two Thumbs Up” rating. Find the probability that this movie will be profitable.
8. The following is a frequency distribution of the weekly earnings of 100 workers selected from a large company. Sketch a relative frequency histogram of the distribution and the relative cumulative frequency ogive. (10 pts.)

<table>
<thead>
<tr>
<th>Weekly Earnings to under</th>
<th>No. of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td>300</td>
<td>400</td>
</tr>
<tr>
<td>400</td>
<td>500</td>
</tr>
<tr>
<td>500</td>
<td>700</td>
</tr>
<tr>
<td>700</td>
<td>1000</td>
</tr>
</tbody>
</table>

Relative frequency distribution

Relative cumulative frequency ogive
Solution of Mid-term 1 of Fall 2012 (subject to error)

1. a) Quantitative, continuous, ratio scale
   b) Variance = (standard deviation)^2 = (3.692)^2 = 13.631
      It measure the variability (spread) of the book value.
   c) CV = \frac{s}{x} \times 100 = \frac{3.692}{9.8} \times 100 = 37.67 \%
      It measures the relative variability with respect to the mean.
   d) \sigma = \sqrt{\frac{49}{50}} \times 3.692 = 3.655
   e) For the 25th percentile: \( i = \frac{np}{100} = \frac{(50)(25)}{100} = 12.5 \)
      Since \( i = 12.5 \) is not an integer, the 13th observation, which is 7, is the 25th.
      For the 75th percentile: \( i = \frac{np}{100} = \frac{(50)(75)}{100} = 37.5 \)
      Since \( i = 37.5 \) is not an integer, the 18th observation, which is 11, is the 75th.
      IQR = Q_3 - Q_1 = 11-7=4
   f) Skew to the right
      • First evidence: Skewness is positive (1.3)
      • Second evidence: Mean > Median

2. a) \( \frac{24 + 35 + \cdots + 63}{6} = 43.333 \text{ or by calculator} \)
   b) \( \sqrt{\frac{(24 - 43.333)^2 + (35 - 43.333)^2 + \cdots + (63 - 43.333)^2}{5}} = 18.533 \text{ or by calculator} \)
   c) \( \frac{35 + 35}{2} = 35 \)
      It measures the central tendency (center) of the data.
   d) MAD = \frac{|24-43.333|+|35-43.333|+\cdots+|63-43.333|}{6} = 15.444

3. C: owns a credit card; D: owns a debit card
   a) \( P(C' \text{ and } D') = \frac{10}{200} = 0.05 \)
   b) \( P(C|D) = \frac{P(C \cap D)}{P(D)} = \frac{60}{200} / \frac{80}{200} = \frac{6}{8} = 0.75 \)

4. \( \sqrt{(1 + 0.1025)(1 - 0.0213)(1 + 0.0389)(1 - 0.0288)(1 + 0.0163)} - 1 = 0.02043, \text{ thus 2.043%} \)
5. Let F = female, M = male. Then P(F) = 0.28, P(M) = 0.2, P(FM) = 0.04. 
Thus, \( P(F \cup M) = P(F) + P(M) - P(F \cap M) = 0.28 + 0.2 - 0.04 = 0.44 \) or 44%.

6. a) \( Z = \frac{x - \mu}{\sigma} = \frac{12,660 - 11,270}{2780} = 0.5 \)

   b) \( 1 - \frac{1}{k^2} = 0.9, \frac{1}{k^2} = 0.1, k^2 = 10, k = 3.16 \) Therefore, \( (\bar{x} - 3.16 \times s, \bar{x} + 3.16 \times s) = (2485.2, 20054.8) \)

7. Let F = profitable, T = Two Thumbs Up
   a) \( P(F \cap T) = 0.42 \)
   b) \( P(T) = P(F \cap T) + P(F' \cap T) = P(F)P(T|F) + P(F')P(T|F') = 0.6 \times 0.7 + 0.2 \times 0.4 = 0.5 \)
   c) \( P(F|T) = \frac{P(F \cap T)}{P(T)} = \frac{0.42}{0.5} = 0.84 \)

8. 

<table>
<thead>
<tr>
<th>Weekly Earnings</th>
<th>No. of Employees</th>
<th>Rel. Freq.</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 to under 300</td>
<td>15</td>
<td>0.15</td>
<td>0.0015 (=0.15/100)</td>
</tr>
<tr>
<td>300 to under 400</td>
<td>25</td>
<td>0.25</td>
<td>0.0025 (=0.25/100)</td>
</tr>
<tr>
<td>400 to under 500</td>
<td>30</td>
<td>0.30</td>
<td>0.003 (=0.30/100)</td>
</tr>
<tr>
<td>500 to under 600</td>
<td>20</td>
<td>0.20</td>
<td>0.002 (=0.20/100)</td>
</tr>
<tr>
<td>600 to under 1000</td>
<td>10</td>
<td>0.10</td>
<td>0.00025 (=0.10/400)</td>
</tr>
</tbody>
</table>