CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Semester 1 Examinations 2007/08

Module Title: Business Mathematics & Statistics I

Module Code: STAT 6001

School: School of Business

Programme Title: Bachelor of Business – Year 1
Bachelor of Business in Business Administration – Year 1
Higher Certificate in Business – Year 1

Programme Code: BBUSS_7_Y1
BBADM_7_Y1
BBUSA_6_Y1
BBUSE_6_Y1

External Examiners: Dr. P. Robinson
Internal Examiners: Ms. K. Crilly, Mr. C. Daly, Ms. C. Guiney, Dr. S. O Rourke

Instructions: Answer THREE questions. All questions carry equal marks.
Show all calculations IN FULL. Do not write, draw or underline in RED.

Duration: 2 Hours

Sitting: Winter 2007

Note to Candidates: Please check the Programme Title and the Module Title to ensure that you have received the correct examination paper.
If in doubt please contact an Invigilator.
Q1. The manager of a call centre is monitoring the length of time callers have to wait before speaking to a customer service representative. A sample of forty callers was taken and the lengths of time (in minutes) that they had to wait were as follows:

5.8  11.1  15.6  3.9  7.2  12.2  4.0  5.5
4.9  13.6  7.4  11.4  6.7  13.7  8.5  11.4
6.3  5.2  8.8  10.2  17.6  9.5  3.4  5.8
7.7  12.1  10.4  3.7  2.3  4.5  14.9  5.6
9.4  9.1  12.1  8.3  7.9  6.0  10.4  9.8

(a) Form a frequency distribution table with eight class intervals of equal width. (6 marks)

(b) Draw the histogram for the data. (4 marks)

(c) Draw the corresponding ogive for the data. (4 marks)

(d) Use the ogive to estimate (i) the median (ii) the first quartile of the data. (4 marks)

(e) Use the ogive to estimate the proportion of callers who had to wait for 11 minutes or longer. (2 marks)
Q2. A bookmaker’s weekly turnover last year is shown in the frequency distribution below:

<table>
<thead>
<tr>
<th>Weekly Turnover (€000s)</th>
<th>Number of weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 but less than 50</td>
<td>5</td>
</tr>
<tr>
<td>50 but less than 100</td>
<td>7</td>
</tr>
<tr>
<td>100 but less than 150</td>
<td>10</td>
</tr>
<tr>
<td>150 but less than 200</td>
<td>16</td>
</tr>
<tr>
<td>200 but less than 250</td>
<td>8</td>
</tr>
<tr>
<td>250 but less than 300</td>
<td>4</td>
</tr>
<tr>
<td>300 but less than 400</td>
<td>2</td>
</tr>
</tbody>
</table>

(a) Calculate the mean and the standard deviation of the data. (8 marks)

(b) Calculate the median. (4 marks)

(c) Calculate the mode. (4 marks)

(d) On how many weeks did the turnover exceed the mean? (4 marks)

Q3. The following table shows the number of visitors (in hundreds) to a hotel during a period of four years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Quarter 1</th>
<th>Quarter 2</th>
<th>Quarter 3</th>
<th>Quarter 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>54</td>
<td>79</td>
<td>87</td>
<td>61</td>
</tr>
<tr>
<td>2004</td>
<td>58</td>
<td>85</td>
<td>97</td>
<td>73</td>
</tr>
<tr>
<td>2005</td>
<td>64</td>
<td>96</td>
<td>107</td>
<td>89</td>
</tr>
<tr>
<td>2006</td>
<td>76</td>
<td>102</td>
<td>115</td>
<td>94</td>
</tr>
</tbody>
</table>

(a) Plot the data on a time series graph. (4 marks)

(b) Calculate a 4-quarter centred moving average (trend) for the data and plot this on the graph. (8 marks)

(c) Calculate the seasonal index (seasonal variation) for each of the four quarters. (6 marks)

(d) Seasonally adjust the visitor numbers for quarters 3 and 4 of 2006. (2 marks)
Q4.  (a) Give an example of two events that are mutually exclusive.  

(2 marks)

(b) The probability that it will rain in Cork tomorrow is 0.6
The probability that it will rain in Auckland tomorrow is 0.25
Calculate the probability that it will rain in
(i) both cities
(ii) neither of the two cities
(iii) only one of the two cities
(iv) at least one of the two cities

(6 marks)

(c) 80% of the widgets produced by CITech Ltd’s factory are produced on
Production Line A. The remainder are produced on Production Line B.

10% of the widgets produced on Production Line A are defective.
15% of the widgets produced on Production Line B are defective.

(i) If you were to select one widget at random from the factory’s output,
calculate the probability that the widget you select would be defective.

(ii) Yesterday, one widget was selected at random from the factory’s output.
It was defective.
Calculate the probability that it was produced on Production Line B.

(5 marks)

(d) In a casino game, a player rolls a dice once and wins €2 for each point scored
(*if he rolls a 4, for example, he wins €8*)

(i) Calculate the expected value of his winnings

(ii) What does the expected value figure that you have calculated tell us?

(iii) If you owned the casino, how much would you charge players to play this
game? Explain why.

(7 marks)
Statistical Formulae

Mean:
\[
\bar{x} = \frac{\sum fx}{\sum f} = a + c \left( \frac{\sum f'x'}{\sum f'} \right)
\]

Standard Deviation:
\[
\sigma = \sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}} \quad \sigma = \sqrt{\frac{\sum(f^2)}{\sum f} - \left( \frac{\sum f}{\sum f} \right)^2} \quad \sigma = \sqrt{\frac{\sum f'(x'-\bar{x}')^2}{\sum f'} - \left( \frac{\sum f'}{\sum f'} \right)^2}
\]

Median = \[L_M + \frac{\frac{1}{2}(N) - F_{L-1}}{f_M}\]

Mode = \[L_M + \frac{f_M - f_{M-1}}{2f_M - (f_{M-1} + f_{M+1})}\]

\[
\text{Coefficient of Skewness} = \frac{3(\text{Mean} - \text{Median})}{\text{S.D.}}
\]

Coefficient of Variation = \(\frac{\sigma}{\bar{x}} \times 100\)

Laspeyre's Price Index: \(I = \left[ \frac{\sum p_1q_1}{\sum p_1q_0} \right] \times 100\)

Paasche Price Index: \(I = \left[ \frac{\sum p_2q_2}{\sum p_0q_2} \right] \times 100\)

Weighted Arithmetic Mean of Price Relatives Index: \(I = \left[ \frac{\sum p_0x_{W1}}{\sum w} \right] \times 100\)