FEEDBACK TUTORIAL LETTER

2ND SEMESTER 2020

TEST MEMOS

Basic Business Statistics 1B
BBS112S
Q1
1.1 A ✓
1.2 A ✓
1.3 C ✓
1.4 C ✓
1.5 D ✓

Q2
2.1 Systematic Sample
2.2 Simple Random Sample
2.3 Cluster Sample
2.4 Stratified Sample
3.1 \( X \sim N(\mu = 100, \sigma^2 = 12^2) \)
\( n = 50 \)

3.1.1 \( P(95 \leq \bar{X} \leq 100) \)

\[ P \left( \frac{95 - 100}{12 \sqrt{50}} \leq Z \leq \frac{100 - 100}{12 \sqrt{50}} \right) \]

\[ = P(-2.95 \leq Z \leq 0) \]

\[ = 0.5000 - 0.0016 \]

\[ = 0.4984 \checkmark \]

3.2 \( \sigma = 11 \)
\( n = 25 \)
\( \bar{X} = 95 \)

3.2.1 \( \left[ \bar{X} \pm \frac{Z_{\alpha/2}}{\sqrt{n}} \right] \checkmark \)

\[ Z_{\alpha/2} = Z_{0.025} = 1.96 \]
We are 95% confident that the true population mean of \( X \) lies between 90.688 g and 99.312 g.

### 4.1

\[ \overline{X} = 92.7 \text{ grams} \]

### 4.2

\[
\left[ \overline{X} \pm t_{0.025, df=n-1} \left( \frac{S}{\sqrt{n}} \right) \right]
\]

\[ S = 47.640 \]

\[ n = 20 \]

\[ d = 0.1 \]

\[ t_{0.05, df=19} = 2.093 \]

\[ 4.729133 \]
\[ 921 \pm 1.729133 \left( \frac{47.6401}{120} \right) \]

\[ = \left[ 902.5802, 939.4198 \right] \text{ grams} \]

0.85

14 will not make it
186 will make it

\[ \hat{p} = \left( \frac{x}{n} \right) = \left( \frac{186}{200} \right) \]

\[ = 0.93 \]

\[ = 93\% \]

\[ 2 \left[ \hat{p} \pm z \frac{\sqrt{\hat{p}(1-\hat{p})}}{n} \right] \]

\[ \hat{p} = 0.02 \]

Also consider 2.32 or 2.33

\[ z_{0.01} = \frac{2.32 + 2.33}{2} \]
\[
\left[ 0.93 \pm 2.325 \left( \frac{0.93(1-0.93)}{200} \right) \right]
\]

\[
\left[ 0.93 \pm 2.325 \left( 0.0180 \right) \right]
\]

\[
\left[ 0.8882, 0.9719 \right]
\]

We are 98\% confident that the true proportion of the people that will make their payments on time lies between 88.82\% and 97.19\%. 
BBS1B Test 2 Memo

QUESTION 1

1.1 B ✓
1.2 A ✓
1.3 A ✓
1.4 D ✓
1.5 B ✓
1.6 B ✓
1.7 C ✓
1.8 B ✓
1.9 B ✓
1.10 B ✓

QUESTION 2

2.1 \( n = 10, \Sigma x = 65 + 65 + 70 + 67 + 66 + 63 + 63 + 68 + 72 + 71 = 670 \)

\[ \Sigma x^2 = 44982; \bar{x} = \frac{\Sigma x}{n} = \frac{670}{10} = 67 \]

\[ s^2 = 10.2222 \]

\[ s = \sqrt{10.2222} = 3.1972 \]

10

\( H_0: \mu = 65 \)

\( H_a: \mu \neq 65 \)

\[ t_{stat} = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{67 - 65}{3.1972/\sqrt{10}} = \frac{2}{1.0110434414} = 1.978154423 \approx 1.9782 \]

\( \checkmark \)

Reject \( H_0 \) if \( t_{stat} > 2.262157 \) or \( t_{stat} < -2.262157 \).

We fail to reject \( H_0 \), since \( t_{stat} = 1.9782 < 2.262157 \)

At 5% level of significance, we conclude that Mr Mumbuu’s belief is justified.

\( \checkmark \)

Is not justified and the students' belief is correct.
2.2

\[ n = 100, \quad \pi = 9.5(0.095), \quad p = \frac{7}{100} = 0.07 \sqrt{\checkmark} \]

\( H_0: \pi \geq 9.5 \) (0.095) \( \sqrt{\checkmark} \)

\( H_a: \pi < 9.5 \) (0.095) \( \sqrt{\checkmark} \)

\[ z_{stat} = \frac{p-\pi}{\sqrt{\frac{\pi(1-\pi)}{n}}} = \frac{0.07-0.095}{\sqrt{\frac{0.095(1-0.095)}{100}}} = \frac{-0.025}{0.0029321493} = -0.85261 \sqrt{\checkmark} \]

Reject \( H_0 \) if \( z_{stat} < -2.325 \sqrt{\checkmark} \)

We fail to reject \( H_0 \) since \( z_{stat} = -0.85261 > -2.325 \)

At 1% level of significance we conclude that the true proportion of adults who suffer from depression is not lower than the percent in the general adult American population.

**Question 3 [13 marks]**

3.1

\( H_0: \) Political affiliation and opinion on a tax reform bill are independent (no association) \( \sqrt{\checkmark} \)

\( H_a: \) Political affiliation and opinion on the tax reform bill are dependent (there is an \( \sqrt{\checkmark} \) association).

\[ \chi^2_{stat} = \sum \frac{(f_0 - f_e)^2}{f_e} \]

\[ f_e = \frac{row\ total \times column\ total}{grand\ total} \]

<table>
<thead>
<tr>
<th>( f_0 )</th>
<th>( f_e = RT \times CT/GT )</th>
<th>( \frac{(f_0 - f_e)^2}{f_e} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>138</td>
<td>115.14</td>
<td>4.538645128 ( \sqrt{\checkmark} )</td>
</tr>
<tr>
<td>83</td>
<td>85.5</td>
<td>0.0730994152 ( \sqrt{\checkmark} )</td>
</tr>
<tr>
<td>64</td>
<td>84.36</td>
<td>4.913816975 ( \sqrt{\checkmark} )</td>
</tr>
<tr>
<td>64</td>
<td>86.86</td>
<td>6.016343541 ( \sqrt{\checkmark} )</td>
</tr>
<tr>
<td>67</td>
<td>64.5</td>
<td>0.09689922481 ( \sqrt{\checkmark} )</td>
</tr>
<tr>
<td>84</td>
<td>63.64</td>
<td>6.513664362 ( \sqrt{\checkmark} )</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 22.15246865 \sqrt{\checkmark} \]

Reject \( H_0 \) if \( \chi^2_{stat} > 5.991465 \sqrt{\checkmark} \)

We reject \( H_0 \) since \( \chi^2_{stat} = 22.15246865 > 5.991465 \)

At 5% level of significance, we conclude that political affiliation and opinion on a tax reform bill are dependent.
**Faculty Name**: Health and Applied Sciences  
**Name of Department**: Mathematics and Statistics

**QUALIFICATION(S)**:  
- B. Business Admin  
- B. Marketing  
- B. Human Resource Management  
- B. Public Management  
- B. Logistics and Supply Chain Management

**COURSE NAME:** Basic Business Statistics 1B  
**COURSE CODE:** BBS112S

**DATE:** 11 December 2020  
**TIME:** 1 Hour 30 minutes  
**MARKS:** 50

**EXAMINER(s):** Mr. E. Mwahi, Mr. A. Roux, Mr. R. Mumbuu, Mr. G. Tapedzesha, Ms L. Khoa, Mr. N. Ndadi, Ms. A. Sakaria

This memorandum consists of 6 pages excluding this front page
Question 1  [20]

1.1  D ✓ ✓
1.2  B ✓ ✓
1.3  D ✓ ✓
1.4  B ✓ ✓
1.5  C ✓ ✓
1.6  D ✓ ✓
1.7  B ✓ ✓
1.8  C ✓ ✓
1.9  B ✓ ✓
1.10 D ✓ ✓

Question 2  [30]

2.1

\[ \Sigma x = 21 \cdot 18 + 19 + 16 + 18 \cdot 22 + 19 + 24 + 14 + 18 + 15 = 228 \]

\[ \Sigma x^2 = 21^2 + 18^2 + 19^2 \ldots \ldots + 15^2 \]

\[ = 4448 \]

Sample variance \( S^2 = \frac{\Sigma x^2 \cdot (\bar{x})^2}{n-1} \)

\[ S^2 = \frac{4448 \cdot (228)^2}{12} \]

\[ S^2 = \frac{116}{11} \]

\[ S^2 = 10.54545 \]

\( S^2 \approx 10.545 \)

\[ S = \sqrt{10.545} \]

\[ = 3.247376564 \]

\[ = 3.247 \]

2.1.1

\[ \bar{x} = \frac{\Sigma x}{n} \]

\[ = \frac{228}{12} \]

\[ = 19 \]
2.1.2

n = 12

σ = ?

Since sigma(σ) is unknown and

n < 30 (less than 30) we use a t-distribution

\[ t_{0.05 \over 2, n-1} = t_{0.025, 11} = 2.20099 \]

\[ \bar{x} - t_{0.05 \over 2, n-1} \times {s \over \sqrt{n}} \leq \mu \leq \bar{x} + t_{0.05 \over 2, n-1} \times {s \over \sqrt{n}} \]

\[ 19 - 2.20099 \times \frac{3.247}{\sqrt{12}} \leq \mu \leq 19 + 2.20099 \times \frac{3.247}{\sqrt{12}} \]

16.93695009 ≤ \mu ≤ 21.06304991

16.937 ≤ \mu ≤ 21.063

2.1.3 Step 1: Formulate the hypothesis

Ho: \( \mu \geq 20 \)

Ha: \( \mu < 20 \) (claim at Ha)

Step 2: Compute the test statistic

\[ t_{stat} = \frac{\bar{x} - \mu}{s/\sqrt{n}} \]

\[ = \frac{19 - 20}{3.247 / \sqrt{12}} \]

\[ \approx -1.067 \]

Step 3: Formulate the decision rule

\( \alpha = 0.05, t = -1.795885 \)

Rejection area

Area of acceptance

-1.795885 0
Rule: Reject Ho if \( t_{\text{stat}} < -1.795885 \)

**Step: Decision**

We fail to reject Ho/ we do not reject Ho\(_{0}\) since \( t_{\text{stat}} = -1.067 > -1.795885 \)

**Step 5: Conclusion**

At 5% level of significance we conclude that there is no enough evidence to support the claim that the mean fat content of beef burger is less than 20% (the claim is not valid).

2.2

**Step1: State the Hypotheses**

\( H_0 \): There is no relationship between gender and favourite colour at the elementary school

\( H_a \): There is a relationship between gender and favourite colour at the elementary school

NB: Independence (no association) should be considered for \( H_0 \) and vice versa for \( H_a \)

**Step 2: Compute the test statistic**

\[
\chi^2_{\text{stat}} = \sum \frac{(f_o - f_e)^2}{f_e}
\]

<table>
<thead>
<tr>
<th>( f_o )</th>
<th>( fe = \frac{\text{row} \times \text{column total}}{\text{grand total}} )</th>
<th>( \frac{(f_o - f_e)^2}{f_e} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>( \frac{270 \times 120}{500} = 64.8 )</td>
<td>19.12099</td>
</tr>
<tr>
<td>150</td>
<td>( \frac{270 \times 180}{500} = 97.2 )</td>
<td>28.68148</td>
</tr>
<tr>
<td>20</td>
<td>( \frac{270 \times 200}{500} = 108 )</td>
<td>71.70371</td>
</tr>
<tr>
<td>20</td>
<td>( \frac{230 \times 120}{500} = 55.2 )</td>
<td>22.44638</td>
</tr>
<tr>
<td>30</td>
<td>( \frac{230 \times 180}{500} = 82.8 )</td>
<td>33.66957</td>
</tr>
<tr>
<td>180</td>
<td>( \frac{230 \times 200}{500} = 92 )</td>
<td>84.17391</td>
</tr>
<tr>
<td>( \sum f_o = 500 )</td>
<td>( \sum f_o = 500 )</td>
<td>( \chi^2 = 259.796 )</td>
</tr>
</tbody>
</table>

NB: Award full marks (5 marks) for an alternative method which leads to \( \chi^2 = 259.796 \)

**Step3: Formulate the decision rule**

\[
\alpha = 5\% = 0.05
\]

\[
\chi^2_{\alpha} = (r - 1)(c - 1)
\]

\[
\chi^2 = 0.05(2-1)(3-1)
\]
Rule: Reject Ho if $\chi^2_{stat} > 5.99146$

Step 4: Decision
We reject Ho since $\chi^2_{stat}=259.796>5.99146$

Step 5: Conclusion
At 5% level of significance, we conclude that there is a relationship between gender and favourite colour at the elementary school.

2.3

<table>
<thead>
<tr>
<th>Period (Years)</th>
<th>Shipments</th>
<th>3 Point Moving Total</th>
<th>3 Point Moving Average</th>
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<tbody>
<tr>
<td>2008</td>
<td>510.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>542.4</td>
<td>1600.5</td>
<td>533.500</td>
</tr>
<tr>
<td>2010</td>
<td>547.8</td>
<td>1653.7</td>
<td>551.233</td>
</tr>
<tr>
<td>2011</td>
<td>563.5</td>
<td>1671.5</td>
<td>557.167</td>
</tr>
<tr>
<td>2012</td>
<td>560.2</td>
<td>1701.8</td>
<td>567.267</td>
</tr>
<tr>
<td>2013</td>
<td>578.1</td>
<td>1707.5</td>
<td>569.167</td>
</tr>
<tr>
<td>2014</td>
<td>569.2</td>
<td></td>
<td></td>
</tr>
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