**INTRODUCTION TO BUSINESS STATISTICS MARKING SCHEME**

**SECTION A**

Q1. b Q11. a

Q2. d. Q12. b

Q3. b Q13. c

Q4. a Q14. c

Q5. c Q15. c

Q6. c Q16. a

Q7. a Q17. b

Q8. B Q18 d

Q9. a Q19. a

Q10. b Q20. b

**SECTION B**

**Q1.** (a) (i) Payback is the time in which the initial cash outflow of an investment is expected to be recovered from the cash inflows generated by the investment. **A1**

(ii) Advantage: payback period is simple to calculate. **A1**

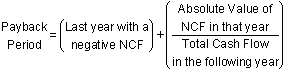
Disadvantage: payback period does not take into account the time value of money. **A1**

(iii) Cash flows in K millions

|  |  |  |
| --- | --- | --- |
| Year | Cash flow | Cumulative Cash Flow |
| 0 1 2 3 4 5 | (50) 10 13 16 19 22 | (50) (40) (27) (11) 8 30 |

**M1 M1**

So



= (or approx 4 yrs), **M1**, **A1**

(b) (i) The Central Limit Theorem let us use the normal distribution for large samples. **A1**

This enables us calculate confidence intervals and use the normal distribution as a test statistic in significance tests. **A1**

(ii) n = 50,  and .

Now the 96% confidence interval is:

, **M1** (for finding 2.05)

, **M1**

**, M1, A1**

Width of the interval**:** 33.74 – 30.26 =3.48, **A1**

(c) P(customer defaults) is , **M1**

(i) P(exactly 2 of 8 customers are likely to default)

=  = **, M1, A1**

(ii) P(at least 2 of 8 customers are likely to default)

= 1 – P(none defaults or 1 defaults), **M1**

= , **M1**

= 0.496, **A1**

**(TOTAL: 20 Marks)**

Q2. (a) (i) Properties of the normal probability distribution:

1. The normal curve is bell-shaped. **A1**
2. The mean, median and mode are equal. **A1**

(Also total area under the curve is 1; the normal curve approaches but never touches the horizontal axis as it extends farther and farther away from the mean)

(ii) Let O be the amount of overdraft. Then .

1. Now , **M1**

= , , **M1**

**=**  = , **M1**

Hence the number of customers with overdrafts of over K40,000 is:

, **M1, A1**

(II) , **M1**

= , , **M1**

=  = , **A1**

(III) , , **M1**

= , **M1**

= , **M1**

Hence the number of customers with overdrafts between K30,000 and K41000 is:

, **M1, A1**

(b)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Project A | | | Project B | | |
| Probability  (p) | Profit (K million) |  | Probability (p) | Profit (K million) |  |
| 0.4 | 35 | 14 | 0.2 | 20 | 4 |
| 0.5 | 60 | 30 | 0.3 | 25 | 7.5 |
| 0.3 | 40 | 12 | 0.3 | 40 | 12 |
| 0.1 | 25 | 2.5 | 0.1 | 80 | 8 |
|  |  | 0 | 0.1 | 120 | 12 |
| Total |  | 58.5 |  |  | 43.5 |

**M1, M1 M1, M1**

The bank should opt for Project A on account of a higher expected value, **A1**

**(TOTAL: 20 Marks)**

**Q3.** (a) (i) An objective function is a linear combination of variables in a linear problem which must be maximized or minimized. **A2**

(ii) Steps:

1. Convert inequalities into equations
2. Sketch straight line graphs
3. Obtain a feasible region
4. Obtain an optimal solution by checking the value of the objective function on the vertices of the feasible region. **A4**

(iii) Let l and h be number of barrels of light and heavy crude to be bought respectively.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Oil grade | Petrol | Heating oil | Jet fuel | Cost/brl |
| Light crude Heavy crude | 0.3 0.3 | 0.2 0.4 | 0.3 0.2 | K31500  K27000 |
| Min required | 0.9 | 0.8 | 0.5 |  |

Then:

Minimise , **M1**

subject to 

, **M1**

,



Sketching the feasible region:

 or : when  and when 

 or : when  and when 

 or : when  and when , **M1**

**M2**

Checking vertices: . Then 

. Then 

 Then  **M2**

Hence buy no barrel of light crude and buy 3 million barrels of heavy crude oil to minimize cost. **A1**

(b) Let L, M and H denote low risk, medium risk and high risk respectively.

Let F and F’ denote a policy holder files a claim and does not file a claim respectively, **M1**



**M2**

Need to find P(H|F) =  **, M1**

=  = 0.58, **M1**, **A1**

**(TOTAL: 20 Marks)**

Q4. (a) Situations: (i) Events occur in a space of time, **A1**

(ii) Events occur in a space of area or region, **A1**

(b) Let X be the number of customers.

(i) Then , **M1**

Hence P(at least two queries) = 1 – P(at most 1 query)

= 1 – P(X = 0 or X = 1) , **M1**

= , **M1**

, **M1,A1**

1. 30 queries every 45 minutes means

, **M1**

Then = , **M1**, **A1**

(c) Hypotheses: : There is no association between account choice and education level

: There is an association between account choice and education level , **M1**

Test statistic: ,

Calculation of expected frequencies:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Education Level** | **Account Type** | | | | **Total** |
| Savings | Current | Investment | Fixed |
| Primary  Secondary  Graduate | 100 (123.7)  300 (276.7)  20 (19.5) | 200 (185.6)  400 (415.1)  30 (29.3) | 50 (39.8)  80 (89)  5 (6.5) | 30 (30.9)  70 (69.2)  5 (4.9) | 380  850  60 |
| Total | 420 | 630 | 135 | 105 | 1290 |

**M2**

Since the expected frequency in the last cell is 4.9, which is less than 5, a direct Chi-squared analysis may be inaccurate, so we combine some categories and calculate fresh expected frequencies for the combined categories. We combine the first and the last rows. **M1**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Education Level** | **Account Type** | | | | **Total** |
| Savings | Current | Investment | Fixed |
| Primary/ graduate  Secondary | 120 (143.3)  300 (276.7) | 230 (214.9)  400 (415.1) | 55 (46.0)  80 (89.0) | 35 (35.5)  70 (69.2) | 440  850 |
| Total | 420 | 630 | 135 | 105 | 1290 |

**M2**

Then  = 

= 10.059, **M2**

Decision Rule: Reject  if , **M1**

Conclusion: Since , we conclude that there an association between account choice and education level, **A1**

**(TOTAL: 20 Marks)**

**Q5**. (a) Now ,  and , **M1** So , **M1**   
   
 Taking logs: , **M1**   
   
 , **M1, A1**

(b) (i) The Consumer Price Index measures the annual cost of living of a typical urban family for a particular country. **A1**

(ii) Let  and  be the number of kgs of beef and chicken consumed by a typical urban family.

Now 2012 has  more chicken than beef basket

i.e. , **M1**

Now a typical cost of a basket of goods in 2010 is

, **M1**

Since  then  , **M1**

and so and , **M1**

These are the amounts to be included in the CPI basket for 2012 . Then the 2012 market value for 5 kgs of chicken and 6.25 kgs of beef is:

, **M1**

Hence the CPI is: , **M1, A1**

Interpretation: This implies that the cost of living for a typical Malawian urban family has increased by 42.5% since the base year. **A1**

(c) Hypotheses: 

, **M1**

Test statistic: Since n = 64 is large, then , **M1**

= , **M1**

Decision Rule: At 5%, reject  when  , **M1**

Conclusion: Since ,  is rejected and conclude that the mean number of cheques referred to drawer is likely more than 35. **M1**, **A1**

**TOTAL: 20 Marks)**