MAS1403 SPECIMEN Exam

Write down your dataset number

Dataset Number = 23 In the REAL exam, you will have your own dataset - might not be 23!

Scenario 1 (Scenario 1)

(a) Calculate the mean and standard deviation for the number of sales made by Janet.

Mean = 6 Standard Deviation = 2.646

(b) Why might the mean and standard deviation not be appropriate summaries of location and spread for Mike's sales?

Outlier of 45. Will influence mean and S.D.

(c) Calculate the median and interquartile range for Mike's data.

Median = 2 IQR = 2

Scenario 2

Construct a stem–and–leaf plot for these data

1	7
2	3, 8
3	1, 3, 5, 8
4	2, 2
5	5

Stem unit = 10 ***Leaf unit = 1***

Scenario 3

(a) Write down the expected weight and variance of the boxes of chocolates in grams.

Expected Weight = $1000g$ Variance = $400g^2$

(b) Consider a random variable Z and suppose that $Z \sim N(0, 1)$. Calculate $Pr(Z > 2.5)$

$$Pr(Z > 2.5) = 0.0062$$

(c) Hence or otherwise calculate the percentage of boxes that will be repacked?

Answer = 0.62% boxes repacked

Scenario 4

(a) What probability distribution might be reasonable to use to model the number of people requiring a special in–flight meal on tomorrow's flight?

$$\text{Answer} = \textit{Binomial}$$

(b) What is the expected number and standard deviation of people requiring a special in-flight meal?

$$\text{Expected Number} = 2 \qquad \text{Standard Deviation} = 1.342$$

(c) Find the probability that, on tomorrow's flight, exactly three customers will require a special in–flight meal.

$$\text{Probability} = 0.19$$

Scenario 5

(a) Using the frequencies provided, calculate the mean number of complaints received in March 2009.

$$\text{Mean} = 1.255$$

(b) Propose an appropriate probability model for the number of complaints received.

$$\text{Answer} = \textit{Poisson}$$

(c) Using the mean you calculated in part (a), and the model identified in part (b), obtain the full probability distribution for the number of complaints,

$$\begin{aligned} P(X = 0) &= 0.285 \\ P(X = 1) &= 0.358 \\ P(X = 2) &= 0.225 \\ P(X = 3) &= 0.094 \\ P(X \geq 4) &= 0.038 \end{aligned}$$

(d) Using the probabilities you found in part (c), and the bonuses shown in the table above, calculate the regional manager's *Expected Monetary Value* for this bonus scheme.

$$\text{EMV} = 494.5$$

Scenario 6

(a) Construct a 95% confidence interval for the average time the employees spend at work in a week.

$$\text{Lower limit} = 35.342 \qquad \text{Upper limit} = 37.058$$

(b) Are the manager's worries justified?

Yes! 37.5 does not lie in the interval!

Scenario 7

Perform an appropriate test to determine whether there is a difference in mean taxi fare from the city centre to the airport between the two firms. You are given the null hypothesis as

H_0 $\mu_T = \mu_C$,

and the alternative hypothesis as

H_1 $\mu_T \neq \mu_C$.

(a) Should we use a z test or a t test?

$$\text{Answer} = t$$

(b) Write down the value of the test statistic

$$\text{Test statistic} = 2.003$$

(c) Write down the degrees of freedom ν of the distribution of the test statistic.

$$\nu = 26$$

(d) Hence or otherwise complete the following table by giving the critical values.

Significance level	10%	5%	1%
Critical value	1.706	2.056	2.779

(e) Using statistical tables or otherwise, input the number of the true statement:

1. p is bigger than 10%.
2. p lies between 5% and 10%.
3. p lies between 1% and 5%.
4. p is less than 1%.

$$\text{True statement} = 2$$

(f) Briefly write down your conclusions.

Slight evidence against Ho. Retain Ho. No difference in fares.

Scenario 8

Perform an appropriate hypothesis test to assess whether or not there is any evidence to suggest that age is associated with preference for the two meals. You are given the null hypothesis:

H_0 there is no association between meal preference and age,

and the alternative hypothesis:

H_1 there is an association between meal preference and age.

(a) Calculate respective expected frequencies for the categories, "Extra Special and Under 25", "Extra Special and 25-50" and "Extra Special and Over 50".

$$29.25, \quad 24.75, \quad 36$$

(b) Calculate respective expected frequencies for the categories, "Good for you! and Under 25", "Good for you! and 25-50" and "Good for you! and Over 50".

$$35.75, \quad 30.25, \quad 44$$

(c) For each respective category, "Extra Special and Under 25", "Extra Special and 25-50" and "Extra Special and Over 50", calculate $\frac{(O-E)^2}{E}$ to 3 d.p.

$$2.327, \quad 0.003, \quad 1.778$$

(d) For each respective category,"Good for you! and Under 25", "Good for you! and 25-50" and "Good for you! and Over 50", calculate $\frac{(O-E)^2}{E}$ to 3 d.p.

$$1.904, \quad 0.002, \quad 1.455$$

(e) Hence, by summing the values you obtained in parts (c) and (d), write down the value of the test statistic.

$$\text{Test statistic} = 7.469$$

(f) Write down the value of the degrees of freedom ν.

$$\nu = 2$$

(g) Hence or otherwise complete the following table by giving the critical values.

Significance level	10%	5%	1%
Critical value	4.61	5.99	9.21

(h) Hence write down the number of the true statement:

1. p is bigger than 10%.
2. p lies between 5% and 10%.
3. p lies between 1% and 5%.
4. p is less than 1%.

$$\text{True statement} = 3$$

(i) Briefly write down your conclusions.

Moderate evidence against Ho. Reject Ho. There appears to be an association.

Scenario 9

(a) Calculate S_{xy}.

$$S_{xy} = -531.1$$

(b) Calculate S_{xx}.

$$S_{xx} = 2380$$

(c) Calculate S_{yy}.

$$S_{yy} = 175.425$$

(d) Calculate the sample correlation coefficient.

$$r = -0.822$$

(e) Calculate the intercept (α) and slope (β) of the best fitting line.

$$\alpha = 20.130 \qquad \beta = -0.223$$

(f) This particular branch of Morrison's is in the process of taking on new checkout staff. Applicants for the new jobs have to undertake a series of aptitude tests, one of which requires them to be able to process at least 9 transactions per minute. Can we expect fifty year old applicant Joe King to pass this aptitude test?

For a fifty year old we predict $y = 8.98$ so no!

Scenario 10

(a) Write down the constraints for the sewing process:

$$8x + 5y \leq 600$$

(b) Write down the constraints for the transfer process:

$$9x + 15y \leq 900$$

(c) Write down the remaining constraints:

$$x \geq 30 \qquad y \geq 10$$

(d) Write down the objective function:

$$\text{Profit} = 22x + 16y$$

(e) What is the minimum profit that the company can make?

$$\text{Answer} = 820(\textit{pounds})$$

(f) Find the values for x and y which satisfy the constraints in (a), (b) and (c):

$$30 \leq x \leq 60, \qquad 10 \leq y \leq 24$$