

0.1 Probability

Question 11. (20 marks)

The frequency of 0 as an input to a binary channel is 0.6. If 0 is the input, then 0 is the output with probability 0.8. If 1 is the input, then 1 is the output with probability 0.9.

- a. (4 marks) Calculate the information per bit contained in the input.
- b. (2 marks) Calculate the probability that the output is 0.
- c. (2 marks) Calculate the probability that the output is 1,
- d. (2 marks) Calculate the probability that the input is 0 given that the output is 0.
- e. (2 marks) Calculate the probability that the input is 1 given that the output is 1,
- f. (2 marks) Calculate the probability that the input is 1 given that the output is 0.
- g. (2 marks) Calculate the probability that the input is 0 given that the output is 1.
- h. (6 marks) Calculate the amount of information transmitted by the channel.
- i. (3 marks) Derive the globally optimal reconstruction rule.

May 2013 Question 4 Probability

	within W	outside O	Totals
Correct time C	83	51	134
Delayed D	24	12	36
Totals	107	63	170

- Probability of departing at correct time

$$P(C) = 107/170$$

- Probability of being delayed and flying outside europe

$$P(D \text{ and } O) = 12/170$$

- Probability of

$$P()$$

- Probability of

$$P()$$

- Probability of

$$P()$$

Q3 The data from Question 1 (reproduced below) should be used to answer the following question.

Ireland Texas 1 3.8 3.7 2 3.9 3.8 3 4.0 3.6 4 3.7 3.3 5 3.6 3.4 6 4.1 3.5 7 3.9 3.6 8 4.0 3.7 9 4.1 3.4

Ireland Texas Sample Mean 3.90 3.56 Standard Deviation 0.173 x

(a) Fill in the missing section from the above table (2 marks) (b) Does the data provide sufficient evidence to support the hypothesis that the populations are of equal variances? Use a 5 (c) You are required to test the hypothesis that there is no statistical difference between the number of units produced at each plant. Use a test with a 5

Q4 (a) Under what circumstances is it appropriate to use the binomial distribution when calculating probabilities? (1 mark)

(b) Flextronics supply PCB boards to Dell. You are a production manager with Dell. There is a constant probability of 0.01 that a board will be defective. You select 20 boards at random. What is the probability that: (i) 0 boards will be defective (ii) 1 or more boards will be defective (iii) 2 or less boards will be defective (6 marks)

(c) Flaws occur in an LCD display at the rate of 0.5 per square mm. Calculate the probability that: (i) exactly 2 flaws will occur in a square mm section (ii) exactly 3 flaws will occur in a 5 square mm section (iii) 5 or more flaws will occur in a 10 square mm section (9 marks) (d) There is a constant probability of 0.05 that the power supply in a server network will fail. You are required to calculate the probability that the power supply will fail the 4th time it is switched on. (4 marks)

Q5 A manufacturing technology engineer wanted to establish if there was a relationship between the pull strength of injection moulded parts and the dwell time in the mould. A random sample of 7 different times and their corresponding pounds per square inch were recorded as follows:

X Y Time (in hours) Pull Strength 1 2.8 7.8 2 2.9 8.1 3 3.1 8 4 3.3 8.4 5 3.7 8.6 6 3.9 8.8 7 4.1 9

$\sum xy = 200.89$ $\sum x^2 = 82.46$ $\sum x = 23.8$ $\sum y = 58.7$

(a) You are required to i. Draw a scattergram and comment on its features ii. Find the regression equation and plot the regression equation on scattergram (8 marks)

The data was entered into Minitab and the following outputs were generated

Predictor Coef SE Coef T P Constant 0.2880 19.07 0.000 Hours 0.08391 10.14 0.000

S = 0.1041 R-Sq = 95.4

(b) You are requested to explain how the T-value of 10.14 was calculated and to interpret the corresponding P value of 0.000 (4 marks)

PTO

(c) Fill in the blanks from the following tables and explain the relationship between F value of 102.76 and the T-value of 10.14 in section (b) (8 marks) Analysis of Variance Source DF SS MS F P Regression x 1.1144 1.1144 102.76 0.000 Residual Error x xx xxx Total x 1.1686

Observation Time Pull Strength Fitted value Residual 2