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THE NATIONAL UNIVERSITY OF IRELAND, CORK

COLAISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

SUMMER EXAMINATION 2011

ST1023 – Introduction to Business Statistics

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ANSWER QUESTION 5 AND TWO OTHER QUESTIONS.

A list of statistical formulae and selected statistical tables are provided at the end of the examination paper. Graph Paper is available. A non-programmable calculator may be used provided that it does not contain any information stored by any person prior to the examination.

Fifteen minutes of reading time are permitted prior to this examination.

1.5 Hours

Question 1

A manufacturing company keeps records of the numbers of defective items it produces per day. A random sample of days was selected. From their records, the company calculated the proportion of defective items produced per day. The frequency distribution of proportions defective is as follows:

Proportion Defective	Number of Days
0% - 1%	66
1% - 2%	44
2% - 3%	32
3% - 4%	19
4% - 5%	8
5% - 6%	5
6% - 8%	4
8% or more	2

- (a) Draw a histogram for the distribution of proportions defective. Comment on its shape.
- (b) Explain how you determined the heights of the bars for the last two frequency classes in preparing the histogram.
- (c) Provide a numerical measure to describe the proportions defective. Justify your choice of numerical measure.
- (d) Calculate the first quartile and interpret the value. State any assumptions that you make. Assess whether these assumptions are valid.
- (e) The manufacturing company operates a policy which specifies that if the proportion defective exceeds 4.75% on any given day, an investigation of the manufacturing process must be undertaken. Estimate the percentage of days on which such an investigation would be undertaken.
- (f) The manufacturing company reviewed the policy referred to in part (e). They want to change the cut-off for the proportion defective that necessitates the investigation of the manufacturing process (currently 4.75%). Estimate the cut-off that should be used to ensure that the percentage of days on which investigations would be undertaken is at most 5%.

Question 2

- (a) The owner of a restaurant has conducted a survey of 600 customers to study how demand for dessert depends on gender and also on whether a main course of beef has been ordered. The data are as follows:

	Gender	
Dessert ordered	Male	Female
Yes	96	40
No	224	240

Beef main course		
Dessert ordered	Yes	No
Yes	71	65
No	116	348

What is the probability that a randomly chosen customer:

- (i) does not order a beef main course?
 - (ii) orders a dessert or a beef main course?
 - (iii) is a female and does not order a dessert?
 - (iv) Given that the customer is a female, what is the probability that she does not order a dessert?
 - (v) Are gender and ordering dessert independent?
- (b) A gardener has six rows available in his vegetable garden to place tomatoes, eggplant, peppers, cucumbers, beans and lettuce. Each vegetable will be allowed one and only one row. How many ways are there to position these vegetables in his garden?
- (c) An investment portfolio will consist of a mix of a corporate bond fund and a common stock fund. The following information about the annual returns (per €1000) under different economic conditions is available:

State of economy	Probability	Bond return(€)	Stock return(€)
Recession	0.10	-30	-150
Stagnation	0.15	50	-20
Slow growth	0.35	90	120
Moderate growth	0.30	100	160
High growth	0.10	110	250

Calculate the expected return of the portfolio if the portfolio contains:

- (i) Bonds only.
- (ii) Stocks only.
- (iii) 50% Bonds + 50% Stocks.

On the basis of these calculations, which portfolio would you recommend? Explain.

Question 3

The sales of a certain frozen fish brand at a supermarket per week follow a Normal distribution with a mean of 680 packets with a standard deviation of 45 packets.

- (a) Find the probability that the weekly sales exceed 700 packets.
- (b) Find the probability that the weekly sales are less than 720 packets.
- (c) Find the probability that the weekly sales are between 650 and 750 packets.
- (d) The supermarket's purchasing manager increases the weekly order for this frozen fish brand following any week during which sales were in the highest 10%. Determine the value of weekly sales that prompts the purchasing manager to increase the next weekly order.
- (e) The supermarket's purchasing manager decreases the weekly order for this frozen fish brand following any week during which sales were in the lowest 15%. Determine the value of weekly sales that prompts the purchasing manager to decrease the next weekly order.
- (f) The purchasing manager has taken a random sample of 10 weeks' sales. What is the probability that the mean sale value is less than 670 packets?
- (g) The weekly sales of a competing frozen fish brand also follow a Normal distribution. The mean for this brand is 440 packets with a standard deviation of 52 packets. Assuming that the sales of the two brands are independent, what is the probability that the combined weekly sales of the two brands exceed 1200 packets?

Question 4

- (a) An insurance broker believes that for any client, the probability of making a sale is $p=0.4$. Suppose that this broker randomly selects 5 clients.
 - (i) How many sales may the broker expect to make from these 5 clients?
 - (ii) What is the probability that the broker makes exactly 1 sale?
 - (iii) What is the probability that the broker makes between 2 and 4 sales (inclusive)?
 - (iv) What is the probability that the broker makes less than 5 sales?
- (b) The IT manager of a large company reports 3 computer failures during the past 10 days. From this fact he assumes the number of computer failures follows a Poisson distribution with a rate of $\lambda = 3/10 = 0.3$ failures per day.
 - (i) What is the probability that no failures occur on any given day?
 - (ii) What is the probability that at least 3 failures occur on any given day?

- (iii) What is the probability that at most 2 failures occur on any given day?
- (iv) What is the expected number of failures during a 5-day week?
- (v) Given that each technical failure costs on average €400 to fix, how much should the company budget for fixing its computer failures in any given week?

Question 5 (Compulsory)

- (a)
 - (i) Explain what is meant by *sampling error*.
 - (ii) Explain what is meant by a *confidence interval*.
 - (iii) Explain why it is preferable to quote a confidence interval rather than just a point estimate.
- (b) Suppose that shopping times for customers at a particular local grocery store are normally distributed. A random sample of 40 shoppers had a mean shopping time of 25 minutes with a standard deviation of 6 minutes.
 - (i) Find a 95% confidence interval for the mean shopping time customers spend in the shop.
 - (ii) The manager of the shop calculated the 99% confidence interval for the mean shopping time to be (22.55 , 27.44). Explain why this confidence interval is different to the one you found in (i).
 - (iii) Based on the information from this sample, find the sample size required to estimate the mean shopping time to within 1 minute with 99% confidence.
- (c) The management of a multinational company wants an estimate of the proportion of the company's employees who would favour a modified bonus plan. From a random sample of 344 employees, it was found that 261 were in favour of this particular plan.
 - (i) Find a 90% confidence interval of the true population of employees in favour of the modified bonus plan.
 - (ii) Interpret the confidence interval found in (i).
 - (iii) Was management correct in suspecting that 85% of all employees would support the new plan?
 - (iv) Based on the information from this sample, find the sample size required to estimate this proportion to within 1% with 95% confidence.