UNIVERSITY OF BOLTON

SCHOOL OF BUSINESS AND CREATIVE TECHNOLOGIES

ACCOUNTANCY PATHWAY

SEMESTER 2 EXAMINATIONS 2009/2010

QUANTITATIVE METHODS FOR ACCOUNTANTS

MODULE NO: ACC1009

Date: Thursday 3rd June 2010 **Time: 10:00 – 13:00**

INSTRUCTIONS TO CANDIDATES:

There are SIX questions on this paper.

Answer FOUR questions.

You MUST answer NO MORE THAN TWO questions from SECTION A.

You MUST answer AT LEAST TWO questions from SECTION B.

All questions carry equal marks.

Calculators may be used, but full explanations and working must be shown.

CANDIDATES REQUIRE:

Formulae Sheets, which include Statistical Tables.

Graph paper (five sheets)

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SECTION A - answer NO MORE THAN TWO questions from this section

1. XM Electronics produces two key circuits for many electronic devices. A simpler circuit is the XM1, on which they make a unit profit of 30p, and a more complex version is the XM Supreme which is worth £1.05 (105p) profit per unit.

   Both circuits require Omega and Delta components which are sourced from suppliers who can only offer a maximum of 36000 Omegas and 30000 Deltas per month. XM1s need only 1.5 Omegas and 3 Deltas, but XM Supremes need 6 Omegas and only 2 Deltas.

   The circuits also require time in the packaging department which offers a maximum of 3200 machine hours per month. XM1s need only 10 minutes of packaging machine time, but XM Supremes take three times as long.

   XM's sales support team can provide backing for up to 8500 XM1s per month, and only 5500 XM Supremes.

Required:

a) Formulate XM's problem as a linear programming problem to establish output levels which will maximize their potential monthly profit.

(10 Marks)

b) Present the information in a graphical form, and make use of the diagram to calculate and recommend the optimum solution to XM.

(9 Marks)

c) Calculate and explain the significance of the relevant shadow prices.

(6 Marks)

TOTAL 25 MARKS

Section A continued over
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Section A continued

2. The IT department of a very large organization has a significant number of network support computers and servers. For a sample of seven of these machines, information has been collected on there age and the cost of their maintenance last year.

Machine	Maintenance Cost (£s per year)	Age of Computer (Years)
A	850	6
B	400	2
C	980	7
D	440	4
E	790	4
F	140	1
G	320	3

Required:

a) Calculate the Pearson product moment correlation coefficient, between the maintenance costs of the computers and their age.

Explain fully the meaning and significance of your result.

(8 Marks)

b) Calculate the least squares best regression line to fit the data, and draw a graph of the scatter diagram with superimposed best line.

(9 Marks)

c) Managers are interested in the potential for keeping regular annual server maintenance costs below £500, and the cost implications of keeping server computers for periods as long as 8 years. Make use of your best line to recommend the length of time the company should keep computers operational in order to keep costs below the £500 target, and the cost implications of an 8 year server life.

Give a detailed explanation of the strengths, weaknesses, and problems associated with the methods you use.

(8 Marks)

TOTAL 25 MARKS

Section A continued over
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Section A continued

3. The starting salaries available to finance and accounting graduates of northern universities have been the subject of a recent survey. The results are illustrated in the following grouped frequency table:

Average Salary (£000)	Number of Appointments
8 and less than 12	16
12 and less than 14	30
14 and less than 15	60
15 and less than 16	48
16 and less than 18	42
18 and less than 26	24

Required:

a) Draw a histogram to illustrate the information.

(6 Marks)

b) Draw a cumulative frequency curve, and from it estimate the median and quartile salaries.

(8 Marks)

c) Calculate, with explanation, the number of graduates starting on salaries between £11000 and £21000

(4 Marks)

d) Make use of the information in the question, and that developed in parts a), b) and c) to make extensive comments about the distribution in the context of the study.

(7 Marks)

TOTAL 25 MARKS

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SECTION B - answer AT LEAST TWO questions from this section

4. At Premier Paints, some extremely high tech machinery is employed to fill tins with the paint of the correct style and colour. A well tried and tested process has revealed the following characteristics.

Each filling machine is either correctly adjusted (94% of the time) or incorrectly adjusted.

If the machine is correctly adjusted it produces defective tins of paint only 3.5% of the time, but if an incorrectly adjusted machine is allowed to carry on producing output, as many as 67% of tins will be defective and therefore rejected at significant expense to PP.

Required:

a) During a randomly selected machine filling run, what is the probability that a single randomly selected tin of paint will need to be rejected? (Use of a probability tree is advised.)

(10 Marks)

b) When a randomly selected paint tin is defective, what is the probability that it came from an incorrectly adjusted filling machine which must be repaired?

(8 Marks)

c) If a second tin is then selected at random and proves to be perfectly filled, using the most recent prior probabilities established in b), what is the probability that this second tin was filled by a correctly adjusted machine? (You are again advised to make use of a new tree diagram)

(7 Marks)

TOTAL 25 MARKS

Section B continued over
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Section B continued

5. a) Research carried out by one of the financial services watchdogs suggests that 15% of UK pension plans have been sold with insufficient advice to the purchaser. Consider a randomly selected focus group of 8 recent purchasers.

Required:

i) Use the formula for the appropriate probability distribution to determine the probability of there being no cases of insufficient advice given to the 8 individuals.

(3 Marks)

ii) Use the formula to find the probability of more than two cases of insufficient advice.

(4 Marks)

b) The financial advisors for the pension plans in question have found that on average four customers per quarter (of a year) complain about the plan they have purchased each.

Required:

i) Use the formula for an appropriate probability distribution to determine the probability that only two customers will complain in the third quarter of 2010.

(3 Marks)

ii) Use the formula to find the probability that more than two will complain in the next quarter.

(4 Marks)

c) A large firm of accountants has been recovering from the recession fast. This has resulted in a graduate recruitment push in recent months. They use an internally designed aptitude test to help establish the suitability of applicants before selecting those who proceed to interview.

From past experience it has been established that the test scores are normally distributed with a mean of 100 marks and a standard deviation of 12 marks.

Question 5c) continued over
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Question 5c) continued

Required:

i) Candidates scoring below 79 marks are eliminated at this first stage. What percentage of graduates advance to interview (stage two)?

(4 Marks)

ii) A "graduate plus" management traineeship is offered to the top 8% of candidates each year. What is the relevant indicative score such candidates would need to obtain?

(4 Marks)

iii) If the "graduate plus" selection budget is subject to reduction so that only 6% of candidates can be accommodated in future, to what should the cut-off score be amended?

(3 Marks)

TOTAL 25 MARKS

Section B continued over
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Section B continued

6. A major producer of rechargeable power supplies for mobile electronic equipment (phones, laptops etc) has recently tested a sample of a new updated model they are considering introducing. The power supply lives are believed to be normally distributed (as are the existing model). A sample of 100 of these updated individual units is tested and timed with the following results.

Power Supply Life in Hours (Updated Model)	Number of Power Supplies Tested
6 and less than 10	13
10 and less than 12	17
12 and less than 14	35
14 and less than 16	23
16 and less than 20	12

An identical test with a sample of 100 of the current (existing) power supply units produced a mean life of 11.68 hours with a standard deviation of 2.94 hours.

Required:

a) Use the tabular method to calculate the mean and standard deviation life of the new, updated model.

(9 Marks)

b) Use a comparison of confidence intervals for the life of the new updated version, and the current existing power supply units to assess whether the manufacturer can be 95%, or even 99% confident about the updated power supply lasting longer on average than the existing one.

(9 Marks)

c) The samples are believed to come from populations which are normally distributed. Describe and explain fully the evidence which the manufacturer would have collected and relied upon to support these assumptions?

(7 Marks)

TOTAL 25 MARKS

END OF QUESTIONS

Useful Formulae for Quantitative Methods for Accountants

Descriptive Statistics (original data)

Sample Mean

$$\bar{x} = \frac{\sum x}{n}$$

Sample Variance

$$S^2 = \frac{\sum x^2 - \left(\sum x\right)^2 / n}{n-1}$$

Sample Standard Deviation

$$S = \sqrt{\frac{\sum x^2 - \left(\sum x\right)^2 / n}{n-1}}$$

Descriptive Statistics (grouped data)

Sample Mean

$$\bar{x} = \frac{\sum f \cdot m}{n}$$

where m is the midpoint of each class interval and f is the number of values in that class interval.

Sample Variance

$$S^2 = \frac{\sum f \cdot m^2 - \left(f \cdot m\right)^2 / n}{n-1}$$

Sample Standard Deviation

$$S = \sqrt{\frac{\sum f \cdot m^2 - \left(\sum f \cdot m\right)^2 / n}{n-1}}$$

Median

$$Median = L + \frac{k}{f} \cdot w$$

where L = *lower limit of class containing the median*

k = *n/2 - number of data values (C.F.) preceding the median class*

f = *frequency in the median class*

W = *class width*

Probability

Addition Rule $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

or (special case) $P(A \text{ or } B) = P(A) + P(B)$ *A and B mutually exclusive*

Multiplication Rule $P(A \text{ and } B) = P(A) \times P(B)$ *A and B independent*

but generally $P(A \text{ and } B) = P(A) \times P(B/A)$

Conditional probabilities $P(A/B) = \frac{P(A \text{ and } B)}{P(B)}$ *and hence Bayes Theorem*

Permutations and Combinations

Permutations $${}^{n}P_{r} = \frac{n!}{(n-r)!}$$

Combinations $${}^{n}C_{r} = \frac{n!}{r!(n-r)!}$$

Probability Distributions

Binomial Distribution $$P(r) = {}^{n}C_{r} p^{r} (1-p)^{n-r}$$

where n is the number of trials and p is the probability of a success in each trial.

Poisson Distribution $$P(r) = \frac{e^{-m} m^{r}}{r!} \qquad \text{for } r = 0, 1, 2, 3\ldots$$

where r is the number of occurrences of a particular event over a certain unit of time or space, and m = the average number of such occurrences per unit of time or space.

Normal Distribution $$Z = \frac{x - \mu}{\sigma}$$

where μ is the average value of the random variable x, and σ is the standard deviation of the distribution of x.

Confidence Intervals $$\mu = \bar{x} \pm z \frac{\sigma}{\sqrt{n}}$$ 95%, z = 1.96; 99%, z = 2.58 (2.576)

Financial Mathematics

SIMPLE INTEREST $A_n = P(1 + in)$

COMPOUND INTEREST $A_n = P(1 + i)^n$

DEPRECIATION $A_n = P(1 - i)^n$

STRAIGHT LINE DEPRECIATION $A_n = P(1 - in)$

FUTURE VALUE (Of A_0) $A_n = A_0(1 + i)^n$

PRESENT VALUE (Of A_n) $A_0 = A_n(1 + i)^{-n}$

REPAYMENT of ANNUITY (Of A_0) $R = \dfrac{i A_0}{1 - (1 + i)^{-n}}$

PRESENT VALUE of the ANNUITY $A_0 = \dfrac{R[1 - (1 + i)^{-n}]}{i}$

Correlation and Regression

Pearson Product Moment Correlation Coefficient

$$r = \frac{n \times \Sigma xy - \Sigma x \times \Sigma y}{\sqrt{[(n \times \Sigma x^2 - (\Sigma x)^2)(n \times \Sigma y^2 - (\Sigma y)^2)]}}$$

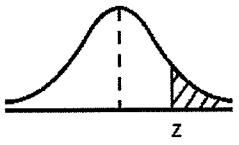
Regression Line of Best Fit $y = a + bx$

Where

$$b = \frac{n \times \Sigma xy - \Sigma x \Sigma y}{[n \times \Sigma x^2 - (\Sigma x)^2]} \quad \text{And} \quad a = \overline{y} - b\overline{x}$$

Areas in the tail of the NORMAL DISTRIBUTION

The table gives the probabilities in the tail of the standard normal distribution, ie the probability that a standardised Normal variable selected at random will be greater than a value of z (= $\frac{x-\mu}{\sigma}$).



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
3.5	0.0002									
3.6	0.0002									
3.7	0.0001									
3.8	0.0001									
3.9	0.0000									
4.0	0.0000									