UNIVERSITY OF BOLTON

OFF CAMPUS DIVISION

WESTERN INTERNATIONAL COLLEGE

BA (HONS) ACCOUNTANCY

SEMESTER ONE EXAMINATION 2024/2025

QUANTITATIVE METHODS FOR ACCOUNTANTS

MODULE NO: ACC4018

Date: Thursday, 9 January 2025 **Time: 1:00 pm – 4:00 pm**

INSTRUCTIONS TO CANDIDATES:

There are FOUR (4) questions on this paper.
Answer all FOUR (4) questions.
This is a 3-hour closed book examination.
All questions carry equal marks.
Calculators may be used but full workings must be shown.

CANDIDATES REQUIRE:

Formulae books, containing statistical tables.
Four sheets of graph paper.

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QUESTION 1

A car manufacturing company produces two products:
An electric car and a hybrid car. The contribution to profit that can be obtained is £20 per unit from an electric car, and £30 per unit from a hybrid car. Assume the factory employs 200 skilled workers and 150 unskilled workers, and they work a 40-hour week. The time required to produce 1 unit of an electric car is 5 skilled hours and 3 unskilled hours, whilst for 1 unit of a hybrid car is 4 skilled hours and 6 unskilled hours.

Required:

a) Arrange the given information into tabular form.
(5 marks)

b) Translate the problem into a linear programming one, identifying and writing down the objective function and the constraints.
(4 marks)

c) Use the algebraic method to calculate how many units of product X and Y would be produced to maximise profitability.
(8 marks)

d) Calculate the graphical solution and plot the inequalities on a graph.
(8 marks)

[TOTAL 25 MARKS]

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QUESTION 2

The table below shows the age of a sample of 40 travelers on a cruise ship.

27	54	38	62	21	57	48	33
37	30	55	35	64	32	54	46
62	42	22	57	28	51	26	37
20	66	46	52	41	39	43	53
32	41	56	39	26	39	62	36

Required:

a) Produce a grouped frequency distribution (GFD) table for this data.
(5 marks)

b) Draw a histogram of the grouped frequency distribution, and calculate the mode.
(5 marks)

c) From the GFD calculate the mean deviation
(5 marks)

d) From the GFD calculate the mean age.
(5 marks)

e) Calculate the corresponding variance and standard deviation.
(5 marks)

[TOTAL 25 MARKS]

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QUESTION 3

Skiware Ltd sell a wide variety of Ski equipment: clothing, boots, skis and snowboards. The quarterly management accounts for recent quarters show that the following numbers of valves were sold in the four quarters (seasons) of the year:

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2021	500	260	310	580
2022	550	300	350	620
2023	580	340	410	660
2024	610	380	440	690

Required:

a) Use a 4-point moving average to analyse the data to show the trend.
(10 marks)

b) Calculate the seasonal variations from the trend.
(7 marks)

c) Use the data to forecast the sales for each quarter of 2025.
(8 marks)

[TOTAL 25 MARKS]

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QUESTION 4

a) A company will have to spend £300,000 on a new plant in two years from now. Currently investment rates are at a nominal 10%.

i. What single sum should now be invested, if compounding is six-monthly?
ii. What is the APR?

(7 marks)

b) A mainframe computer whose cost is £300,000 will depreciate to a scrap value of £15,000 in 5 years.

i. What is the depreciation rate, if reducing balance depreciation is used?
ii. What is the book value of the computer at the end of the third year?
iii. How much more would the book value be at the end of the third year, if straight-line depreciation were used?
iv. What is the depreciation rate, if straight-line depreciation is used?

(10 marks)

c) If you can afford to make a monthly new repayment on your mortgage of £550 and wish to tale out a 100% 30-year repayment mortgage with UOB Building Society who are offering a rate of 4.75% per annum, what price of a house could you afford to purchase?

(8 marks)

[TOTAL 25 MARKS]

END OF QUESTIONS

PLEASE TURN THE PAGE FOR FORMULAE SHEET

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FORMULAE SHEET

STATISTICAL FORMULAE

FREQUENCY DISTRIBUTIONS

Required fractile from a GFD = Lower class limit of fractile class +

$$\left[\frac{\text{Fractile item} - \text{cumulative frequency up to lower class limit of fractile class}}{\text{Fractile class frequency}} \times \text{Fractile class interval}\right]$$

Mean $\bar{x} = \dfrac{\text{sum of values}}{\text{total number of items}} = \dfrac{\Sigma x}{n}$

with GFD: $\bar{x} = \dfrac{\Sigma(f \times MP)}{\Sigma f}$ MP = class Mid Point

Range = Highest value – Lowest value

Quartile deviation $= (Q_3 - Q_1)/2$

Mean deviation $= \dfrac{\Sigma(x - \bar{x})}{n}$ The sign of $(x - \bar{x})$ must be ignored

with GFD: **M.D.** $= \dfrac{\Sigma(f \times (MP - \bar{x}))}{\Sigma f}$

Standard deviation (s) $= \sqrt{\left[\dfrac{\Sigma(x - \bar{x})^2}{n}\right]}$

If the mean is not a rounded number: $s = \sqrt{\left[\dfrac{\Sigma x^2}{n} - \bar{x}^2\right]}$

with GFD: $s = \sqrt{\left[\dfrac{\Sigma(f \times MP^2)}{\Sigma f} - \bar{x}^2\right]}$

Variance: s^2

Coefficient of variation $= \dfrac{s}{\bar{x}} \times 100$

Pearson's Coefficient of Skewness (Sk) $= \dfrac{3\,(\text{Mean} - \text{Median})}{\text{Standard Deviation}}$

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CORRELATION

Regression line of "y on x": $y = a + bx$

where $b = \dfrac{n \times \sum xy - \sum x \times \sum y}{n \times \sum x^2 - (\sum x)^2}$ $a = \dfrac{\sum y - b \times \sum x}{n}$ **n** = number of pairs

Regression line of "x on y": $x = a + by$

where $b = \dfrac{n \times \sum yx - \sum y \times \sum x}{n \times \sum y^2 - (\sum y)^2}$ $a = \dfrac{\sum x - b \times \sum y}{n}$

Pearson product-moment Coefficient of Correlation (r)

$$r = \frac{n \times \sum xy - \sum x \times \sum y}{\sqrt{((n \times \sum x^2 - (\sum x)^2)\,(n \times \sum y^2 - (\sum y)^2))}}$$

Coefficient of determination $r^2 = b_{yx} \times b_{xy} \Rightarrow r = \sqrt{b_{yx} \times b_{xy}}$

Covariance: Cov (x,y) $= \dfrac{\sum (x - \bar{x})(y - \bar{y})}{n} \Rightarrow r = \dfrac{\text{Cov}\,(x,y)}{(s_x \times s_y)}$

Spearman's Coefficient of Rank Correlation: $r' = 1 - \dfrac{6\sum d^2}{n(n^2 - 1)}$

where **d** = the *difference* between the rankings of the same item in each series

PROBABILITY

Multiplication rule: the prob. of a *sequential* event is the product of all its elementary events

$$P(A \cap B \cap C \cap \ldots) = P(A) \times P(B) \times P(C) \ldots$$

Addition rule: the prob. of one of a number of *mutually exclusive* events occurring is the sum of the probabilities of the events

$$P(X \cup Y \cup Z \cup \ldots) = P(X) + P(Y) + P(Z) \ldots$$

Bayes' Theorem $P(E \mid S) = \dfrac{P(E) \times P(S \mid E)}{\sum_i (P(E_i) \times P(S \mid E_i))}$

where **S** is the subsequent event and there are **n** prior events, **E**.

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PROBABILITY DISTRIBUTIONS

Binomial distribution $P(x) = \binom{n}{x} p^x q^{n-x}$ *where* p = constant probability of a success, $q = 1 - p$ = probability of a failure
Mean = np
Standard deviation = $\sqrt{npq}$

Poisson distribution $P(x) = e^{-a}\frac{a^x}{x!}$ *where* $e \cong 2.718$ is a constant
Mean = $a = np$
Standard deviation = $\sqrt{a}$

Simplified Poisson $P(x+1) = P(x) \times \frac{a}{x+1}$

Normal distribution: ***standardised value*** $z = \frac{x - \mu}{\sigma}$

where μ and σ are the mean and standard deviation of the actual distribution

ESTIMATION & CONFIDENCE INTERVALS

- $\bar{x}$, s, p – **sample** mean, standard deviation, proportion/percentage
- μ, σ, π – **population** mean, standard deviation, proportion/percentage

$\Rightarrow$ $\bar{x}$ is a **point estimate** of μ
s is a **point estimate** of σ
p is a **point estimate** of π

Confidence intervals for a population percentage or proportion

$\pi = p \pm z\sqrt{\frac{p(100-p)}{n}}$ for a percentage $\pi = p \pm z\sqrt{\frac{p(1-p)}{n}}$ for a proportion

When using **normal tables**: $\alpha = 100 - \text{confidence level}$

Estimation of population mean (μ) when σ is *known*

$\mu = \bar{x} \pm z\,\sigma/\sqrt{n}$ (**normal tables** for **z**)

Estimation of population mean (μ) for *large sample size* and σ *unknown*

$\mu = \bar{x} \pm z\,s/\sqrt{n}$ (**normal tables** for **z**)

Estimation of population mean (μ) for *small sample size* and σ *unknown*

$\mu = \bar{x} \pm t\,s/\sqrt{n}$ (***t*-tables** for t)

When using ***t*-tables**: $\nu = n\text{-}1$

Confidence intervals for paired (dependent) data

$\mu_d = \bar{x}_d \pm t\,s_d/\sqrt{n_d}$ *where* "$_d$" refers to the *calculated differences*

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FINANCIAL MATHEMATICS

Simple interest $A_n = P\left(1 + \frac{i}{100} \times n\right)$

Compound interest $A_n = P\left(1 + \frac{i}{100}\right)^n$

Effective APR $= \left(\left(1 + \frac{i}{100}\right)^n - 1\right) \times 100\%$

Straight line depreciation $A_n = P\left(1 - \frac{i}{100} \times n\right)$

Depreciation $A = P\left(1 - \frac{i}{100}\right)^n$

The future value of an initial investment A_0 is given by $A = A_0\left(1 + \frac{i}{100}\right)^n$ and the present value of an accumulated investment A_n is given by $A_0 = \frac{A_n}{\left(1 + \frac{i}{100}\right)^n}$ or $A\left(1 + \frac{i}{100}\right)^{-n}$

Loan account

If an annuity is purchased for a sum of A_0 at a rate of i% compounded each period then the periodic repayment is

$$R = \frac{iA_0}{1 - (1+i)^{-n}}$$

and the present value of the annuity A_0 (the loan) is

$$A_0 = R \times \frac{(1+i)^n - 1}{i(1+i)^n} \text{ or equivalently } A_0 = \frac{R[1 - (1+i)^{-n}]}{i}$$

Savings account

A savings plan/sinking fund invested for n periods at a nominal rate of i% compounded each period with a periodic investment of £P matures to £S where

$$S = P(1+i) \times \left(\frac{(1+i)^n - 1}{i}\right)$$

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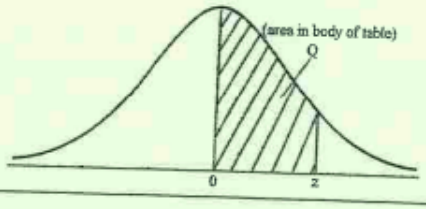
Table 1 Areas under the standard normal curve



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0758
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998

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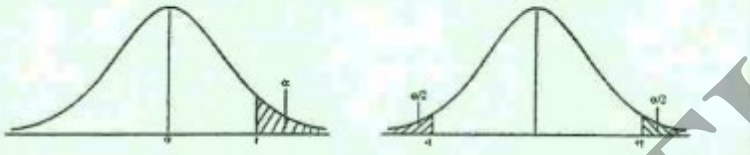
Table 2 Percentage points of the t-distribution

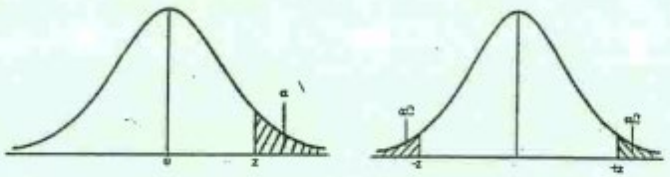


One-tailed Two-tailed

One tail α Two tails α	5% 10%	2.5% 5%	1% 2%	0.5% 1%	0.1% 0.2%	0.05% 0.1%
v = 1	6.31	4.30	12.71	31.82	63.66	636.6
2	2.92	4.30	6.96	9.92	22.33	31.60
3	2.35	3.18	4.54	5.84	10.21	12.92
4	2.13	2.78	3.75	4.60	7.17	8.61
5	2.02	2.57	3.36	4.03	5.89	6.87
6	1.94	2.45	3.14	3.71	5.21	5.96
7	1.89	2.36	3.00	3.50	4.79	5.41
8	1.86	2.31	2.90	3.36	4.50	5.04
9	1.83	2.26	2.82	3.25	4.30	4.78
10	1.81	2.23	2.76	3.17	4.14	4.59
12	1.78	2.18	2.68	3.05	3.93	4.32
15	1.75	2.13	2.60	2.95	3.73	4.07
20	1.72	2.09	2.53	2.85	3.55	3.85
24	1.71	2.06	2.49	2.80	3.47	3.75
30	1.70	2.04	2.46	2.75	3.39	3.65
40	1.68	2.02	2.42	2.70	3.31	3.55
60	1.67	2.00	2.39	2.66	3.23	3.46
∞	1.64	1.96	2.33	2.58	3.09	3.29

v = degrees of freedom α = total percentage in tails

Table 3 Percentage points of the standard normal curve



One-tailed Two-tailed

One tail Two tails	5% 10%	2.5% 5%	1% 2%	0.5% 1%	0.1% 0.2%	0.05% 0.1%
z	1.64	1.96	2.33	2.58	3.09	3.29

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