UNIVERSITY OF GREATER MANCHESTER

GREATER MANCHESTER BUSINESS SCHOOL

BA (HONS) ACCOUNTANCY

SEMESTER ONE EXAMINATIONS 2025/2026

QUANTITATIVE METHODS FOR ACCOUNTANTS

MODULE NO: ACC4018

Date: Friday 16th January 2025 **Time: 2.00pm – 5.00pm**

INSTRUCTIONS TO CANDIDATES:

There are FOUR questions on this paper.

Answer ALL questions.

All questions carry equal marks.

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Question 1

A chocolate manufacturer produces two types of chocolate bar:
Blackholes and Asteroids. The contribution to profit that can be obtained is 10p profit from each Asteroid bar and 20p profit from each Blackhole bar.
Production of an Asteroid bar uses 10g of cocoa and 1 minute of machine time whereas a Blackhole bar requires 5g of cocoa and 4 minutes of machine time.
Altogether 2000g of cocoa and 480 minutes of machine time are available each day.
No other resources are required.

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 Asteroid bar and Blackhole Bar 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)

End of question 1

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Question 2

The Table below shows the production level of a manufacturing company over a 40-week period.

282	259	282	354	270	264	306	345
254	280	359	271	262	302	351	247
261	366	265	257	298	352	255	265
369	264	260	296	357	264	271	356
267	259	294	360	272	265	337	346

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 production level and Range.
(5 marks)

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

(Total 25 marks)

End of question 2

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Question 3

Ascend Ltd sell a wide variety of Afro-Caribbean products: clothing, foot wares and snack. The quarterly management accounts for recent quarters show that the following numbers of items were sold in the four quarters (seasons) of the year:

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2022	3500	4500	5100	7000
2023	3750	4900	5400	7500
2024	4100	5400	5800	8000
2025	4600	6000	6300	8400

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 2026.

(8 marks)

(Total 25 marks)

End of question 3

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Question 4

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a) A company will have to spend £900,000 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 £600,000 will depreciate to a scrap value of £25,000 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 £450 and wish to take out a 100% 25-year repayment mortgage with UOB Building Society who are offering a rate of 6% per annum, what price of a house could you afford to purchase?

(8 marks)

(Total 25 marks)

END OF QUESTIONS

END OF EXAM PAPER

FORMULAS BEGIN OVER THE PAGE

FORMULAE

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

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

Range = Highest value – Lowest value

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

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

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

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

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

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

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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Formulas continued

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CORRELATION

Regression line of "y on x": $\mathbf{y = a + bx}$

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

Regression line of "x on y": $\mathbf{x = a + by}$

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

Pearson product-moment Coefficient of Correlation (r)

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

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

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

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

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

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

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

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

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

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

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Formulas continued

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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

⇒ $\bar{x}$ 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**: $\nu = n-1$

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

The future value of an initial investment A_0 is given by $A_n = A_0\left(1+\frac{i}{100}\right)^n$ 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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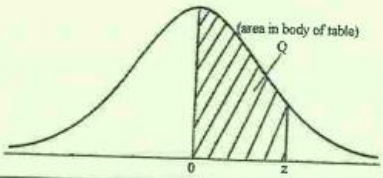
Table 1 Areas under the standard normal curve



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	0.0753
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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Additional Formulae

Financial Mathematics

Compound Interest
S = P (1 + r)^n

Changes in the rate of interest

S = P (1 + r1)y (1 + r2)n-y

Effective rate of interest APR
(1+R) = (1 + r)n

SUM OF GEOMETRIC PROGRESSION

$$S = A\frac{(R^{n}-1)}{R-1}$$

Discounting

$$X = S \times \frac{1}{(1+r)^{n}}$$

Straight Line depreciation

NBV=C(1-i)^n

Dispersion and Averages

Mean deviation $= \frac{\Sigma f(x-x)}{n}$

Standard deviation for grouped data

$$\text{Variance } \sigma^2 = \frac{\Sigma fx^2}{\Sigma f} - \frac{(\Sigma fx)^2}{\Sigma f}$$

$$\text{Standard deviation} = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \frac{(\Sigma fx)^2}{\Sigma f}}$$

END OF FORMULAS

END OF EXAM