

Revision Sheet

A-Level Further Mathematics · Unit 4 Further Probability & Statistics

6 vocabulary items · 29 marks of exam questions (4 questions)

Part 1 · Vocabulary review (6 items). The terms this unit is examined on most. Mark it yourself from the answer key.

Section A · Chinese to English

Write the English word.

Part 2 · Exam questions (29 marks, 4 questions) begins on the next page. They are ordered easy to difficult and none of them has been set before.

- 7 A large number of students are taking a Physics course. They are assessed by a practical examination and a written examination. The marks out of 100 obtained by a random sample of 15 students in each of the examinations are as follows.

Student	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>	<i>J</i>	<i>K</i>	<i>L</i>	<i>M</i>	<i>N</i>	<i>O</i>
Practical examination	66	63	24	52	59	76	88	51	48	36	91	72	68	67	60
Written examination	63	57	39	50	47	71	87	65	56	39	78	70	61	62	70

Use a sign test, at the 10% significance level, to test whether, on average, the practical examination marks are higher than the written examination marks. [5]

[illegible]

8 The random variable X has probability generating function $G_X(t)$ given by

$$G_X(t) = \frac{1}{5} + pt + qt^2,$$

where p and q are constants.

(a) Given that $E(X) = 1.1$, find the numerical value of $\text{Var}(X)$.

[4]

The random variable Y has probability generating function $G_Y(t)$ given by

$$G_Y(t) = \frac{2}{3}t\left(1 + \frac{1}{2}t^2\right).$$

The random variable Z is the sum of independent observations of X and Y .

(b) Find the probability generating function of Z .

[2]

(c) Find $P(Z > 2)$.

[1]

(d) State the most probable value of Z .

[1]

- 9 A factory produces metal discs. The manager claims that the diameters of these discs have a median of 22.0 mm. The diameters, in mm, of a random sample of 12 discs produced by this factory are as follows.

22.4 20.9 22.8 21.5 23.2 22.9 23.9 21.7 19.8 23.6 22.6 23.0

- (a) Carry out a Wilcoxon signed-rank test, at the 10% significance level, to test whether there is any evidence against the manager's claim. [7]

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- (b) State an assumption that is necessary for this test to be valid. [1]

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- 10** Two companies, P and Q , produce a certain type of paint brush. An independent examiner rates the quality of the brushes produced as poor, satisfactory or good. He takes a random sample of brushes from each company. The examiner's ratings are summarised in the table.

Company	Poor	Satisfactory	Good
P	18	43	64
Q	22	22	31

- (a) Test, at the 5% significance level, whether quality of brushes is independent of company. [7]

[illegible]

[illegible]

- (b)** Compare the quality of the brushes produced by the two companies. [1]

[illegible]