

Economics Tripos Part 1 Paper 3
Quantitative Methods in Economics
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Supervision 2 (statistics): Descriptive statistics, probability, random variables

Reading: J P Lewis and A Trill, Statistics Explained

Problems

1. The number of cinemas recorded in English cities are:

5, 5, 7, 5, 3, 4, 2, 1, 4, 2, 6, 4, 1, 1, 3, 5, 5, 4, 1, 0

a) Write out the frequency table and draw a graph of the distribution of cinemas in this sample.

b) What is the sample size?

Find:

c) the mean

d) the sample variance

e) the sample standard deviation

f) the coefficient of variation

g) the mode

h) the median

i) the range

2. The following data shows the distribution of scores in a calculus test taken by 50 students.

<i>Score</i>	<i>Frequency</i>
90-100	2
80-89	3
70-79	22
60-69	16
50-59	6
40-49	1

a) Compute the sample mean, sample median and sample variance.

b) Write the cumulative frequency distribution. Calculate the percentage of students who achieved less than 70 and more than 50 in the test.

3. Calculate the number of permutations in the following:

a) The selection of 4 members of a rowing crew from 6 applicants.

b) The choice of 5 dishes from a Chinese banquet from a choice of 10.

- c) The choice of 3 representatives from a class of 200.
4. Calculate the number of combinations in the following:
- The selection of 4 members of a rowing crew from 6 applicants.
 - The choice of 5 dishes from a Chinese banquet from a choice of 10.
 - The choice of 3 representatives from a class of 200.
 - Explain the difference between a permutation and a combination.
5. How many different committees consisting of two men and two women can be chosen from a group of six men and five women?
6. Two fair coins, 10p and 50p, are tossed. Find the probabilities of:
- Both showing heads
 - Different faces showing up
 - At least one head
 - You are told that the 10p shows heads. What is the probability that both show heads? (hint: use conditional probabilities)
 - You are told that at least one of the two coins shows heads. What is the probability that both show heads?
7. Given that $\Pr(A) = 0.2$, $\Pr(B) = 0.6$, $\Pr(A \cup B) = 0.7$, find $\Pr(A^c \cup [A \cap B])$.
8. The table below shows shopping data recorded in Tesco. It records the number of people who bought a particular type of food along with their gender. The total sample size is 1100.

	<i>Organic food</i>	<i>Non-organic food</i>
<i>Female</i>	400	350
<i>Male</i>	300	50

- A consumer is randomly chosen from this sample.
- Calculate the probability that the person buys organic food.
 - Knowing that the person is female, calculate the probability that she buys organic food.
 - Knowing that the person is female, calculate the probability that she buys non-organic food.
 - Are the two events (gender and food type) independent?

9. Two random variables have the following probability distribution:

	$X = 1$	$X = 2$	$X = 3$
$Y = 1$	1/18	1/9	1/9
$Y = 2$	1/18	1/9	2/9
$Y = 3$	1/9	2/9	0

- What is $\Pr(Y = 2)$?

- b) What is $\Pr(Y = 2 \mid X = 2)$?
- c) Are X and Y independent?
- d) Calculate $E(Y)$ and $E(Y \mid X = 2)$.

10. A machine produces cylinders that are defective with probability 0.1. Suppose 4 cylinders are randomly chosen. What is the probability that

- a) all are defective
- b) at least one is defective
- c) only one is defective
- d) none are defective?
- e) If 500 cylinders are produced in a day, how many would you expect to be defective? (hint: use the binomial distribution)

11. Tripos 2007 C1

12. Tripos 2007 C3

13. Tripos 2007 C4

14. Tripos 2008 C3

15. Tripos 2008 C4

16. Tripos 2008 C5