

MAS 108

Probability I

In-term Test

8 November 2002, 10:05am–10:55am

Write your name and student number in the spaces below.

Answer all questions. Write all your answers in the boxes provided.

Electronic calculators may not be used in this examination.

Name: _____

Student Number: _____

1 (10 marks) Of the Underground trains that stop at Stepney Green station, 80% are District Line trains, 25% run late, and 15% are District Line trains running late. Find the probability that a train is a District Line train given that it is running late.

2 (20 marks) State Kolmogorov's axioms for probability. (5 marks)

Use the axioms to prove each of the following:
(a) $P(A') = 1 - P(A)$; (10 marks)

(b) $P(\emptyset) = 0$. (5 marks)

3 (20 marks) I have a fair 4-sided die bearing the numbers $1, \dots, 4$. I roll the die twice.

(a) What is the sample space? (5 marks)

(b) Let A be the event “the first number is 3”. Find $P(A)$. (5 marks)

(c) Let B be the event “the sum of the numbers is even”. Find $P(B)$. (5 marks)

QUESTION CONTINUED ON NEXT PAGE

(d) Are A and B independent? (5 marks)

4 (15 marks) My desk drawer contains four red pens, three blue pens, and two green pens. I select three pens from the drawer (without replacement).

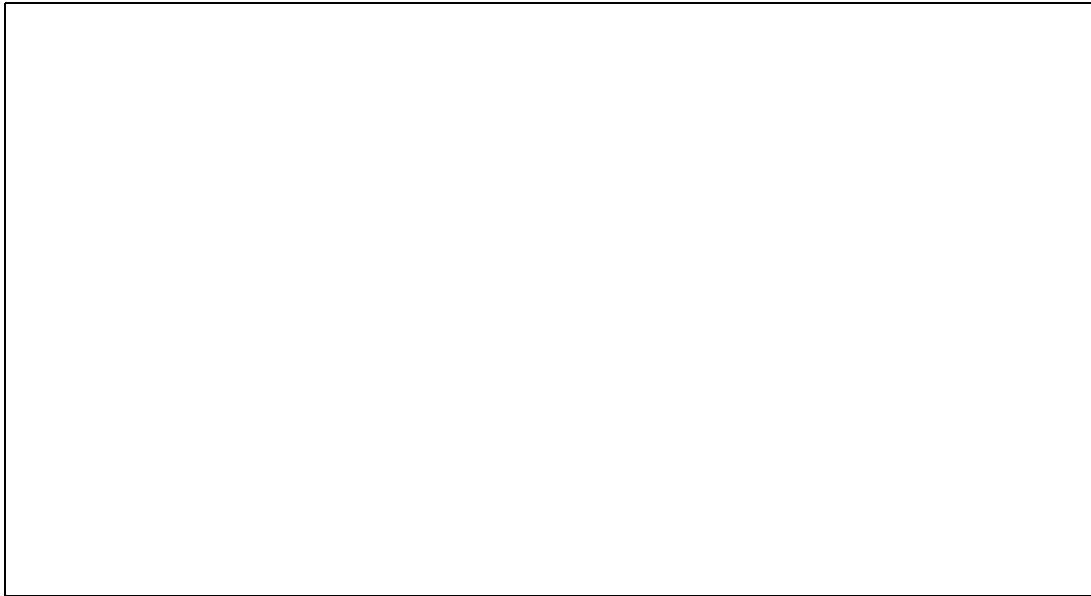
(a) What is the cardinality of the sample space? (5 marks)

(b) What is the probability that my selection includes one pen of each colour? (10 marks)

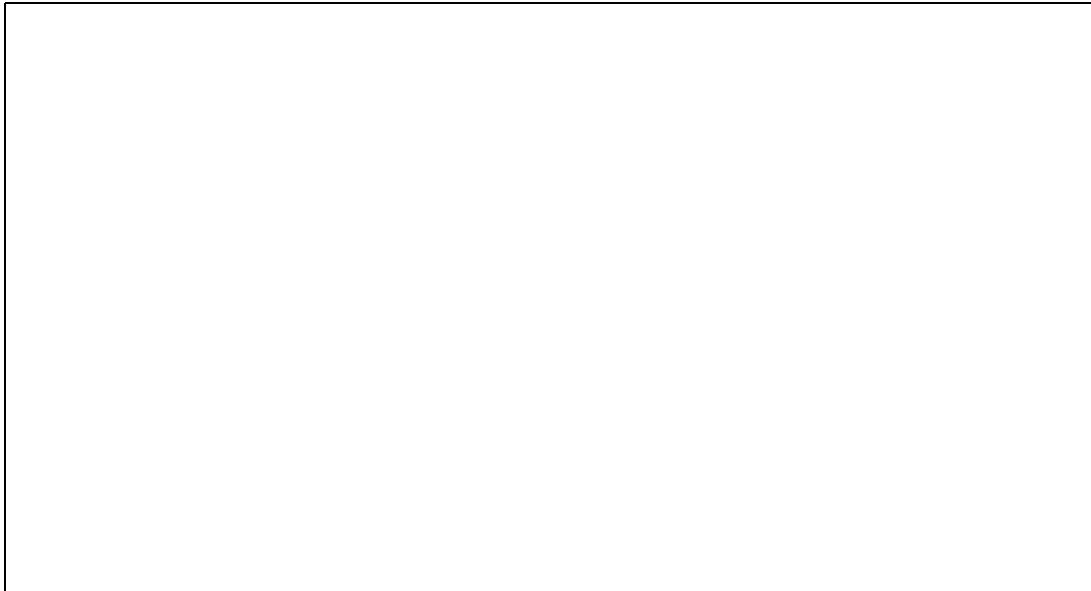
5 (20 marks) Two companies, A and B , manufacture kettles. 8% of A 's kettles are faulty and 3% of B 's kettles are faulty.

A department store buys one-fifth of its kettles from A and four-fifths from B .

(a) What is the probability that a random kettle in the store is faulty? (10 marks)



(b) Given that a kettle in the store is faulty, what is the probability that it is made by company A ? (10 marks)



6 (15 marks) A random variable N has the following probability mass function.

n	1	2	5	10
$P(N = n)$	0.4	0.3	0.2	p

(a) Find p . (5 marks)

(b) Find $E(N)$. (5 marks)

(c) Find $\text{Var}(N)$. (5 marks)