

MAS108 Probability I

Mid-term Test

9:30am, Friday 9 November 2007

Duration: 45 minutes

Answer All Questions. Each question carries 20 marks.

Calculators are not permitted in this examination.

Write your answers on the question paper. If you need more space then use the blank pages at the end of the booklet and be sure to number your answers clearly

NAME:

STUDENT NUMBER:

1.

Amanda and Brian are playing tennis. The match ends when one of them has won two sets and that player is declared the winner. Suppose that each set they play is won by Amanda with probability $2/3$ and that the result of each set is independent of the results of the others.

- i) Calculate the probability that Amanda wins the match.

- iii) Calculate the probability that the match lasts three sets.

- iii) Calculate the conditional probability that Amanda wins the match given that the match lasts three sets.

2.

- i) State (without proof) the inclusion-exclusion formula for two events A and B .

- ii) State (without proof) the inclusion-exclusion formula for three events C , D and E .

- iii) Use the inclusion-exclusion formula for two events (which you may assume without proof) to prove the inclusion-exclusion formula for three events.

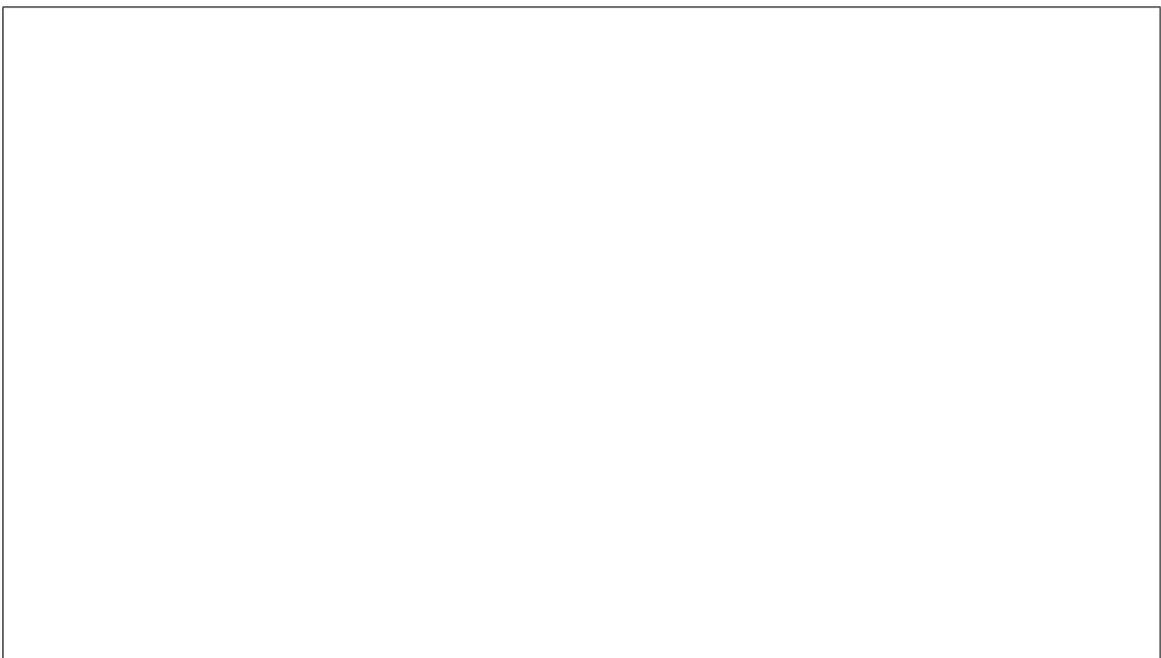
3.

A bag contains 10 marbles 6 of which are red and 4 of which are green.

- i) I remove 3 marbles from the bag without replacement and with all choices equally likely. What is the probability that there are exactly 2 red marbles in my selection? Give your final answer as a fraction.



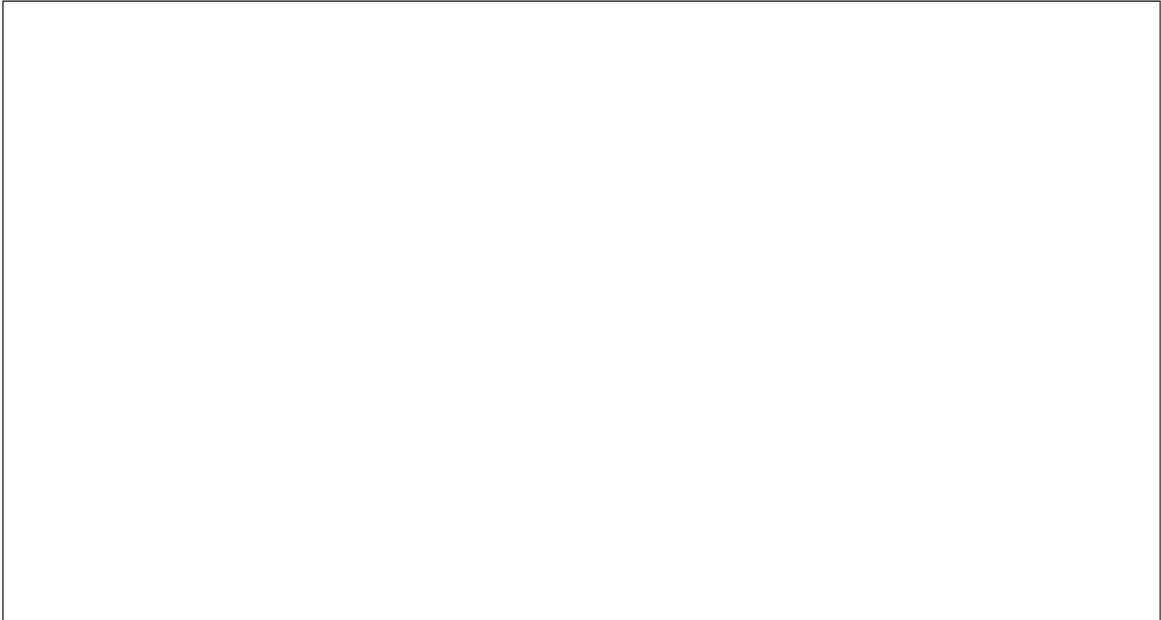
- ii) I remove a single marble from the bag, note its colour, and replace it in the bag. I perform this procedure 3 times in total. What is the probability that I pick a red marble exactly 2 times? Give your final answer as a fraction.



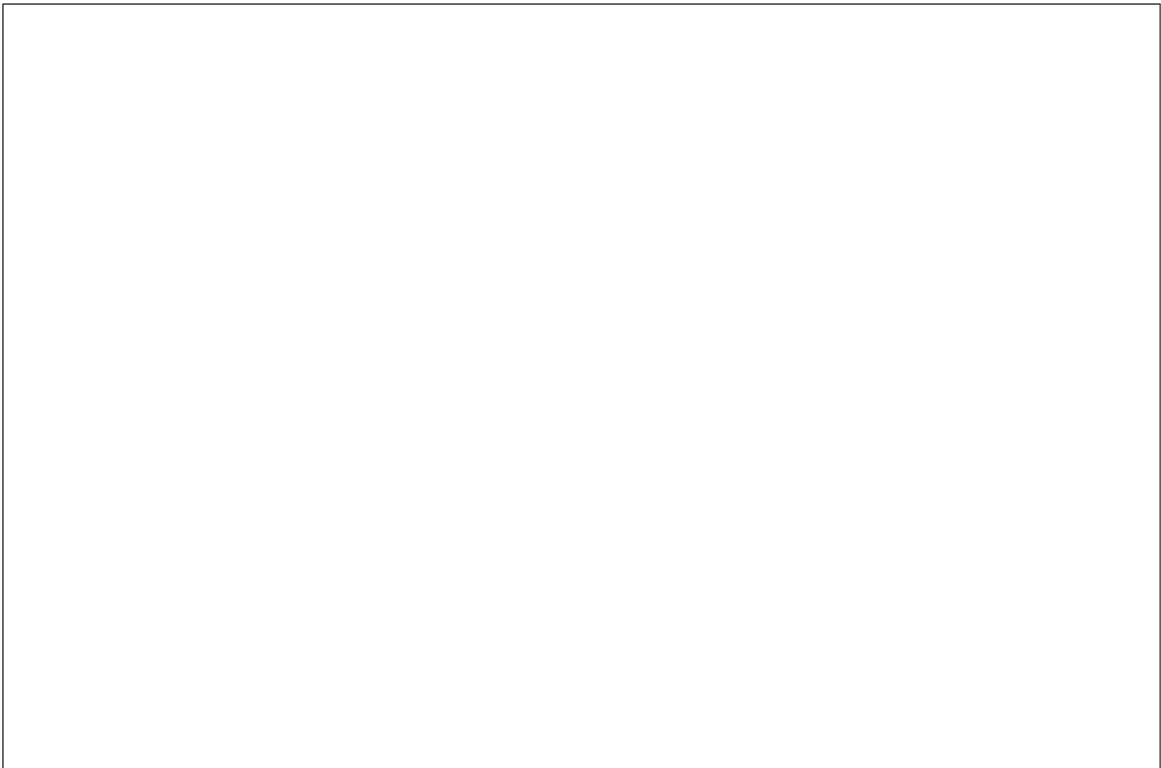
4.

In a group of 100 students 40 play rugby, 60 play cricket, and 12 play both sports. A student is chosen at random from the group with each of the 100 equally likely to be chosen.

- i) What is the probability that the chosen student plays exactly one of the two sports?



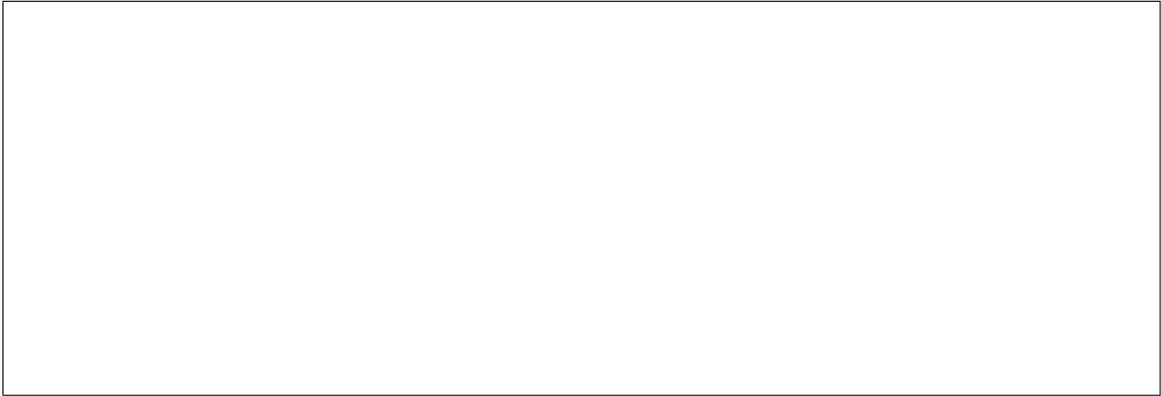
- ii) Are the events “the chosen student plays rugby” and “the chosen student plays cricket” independent? Justify your answer.



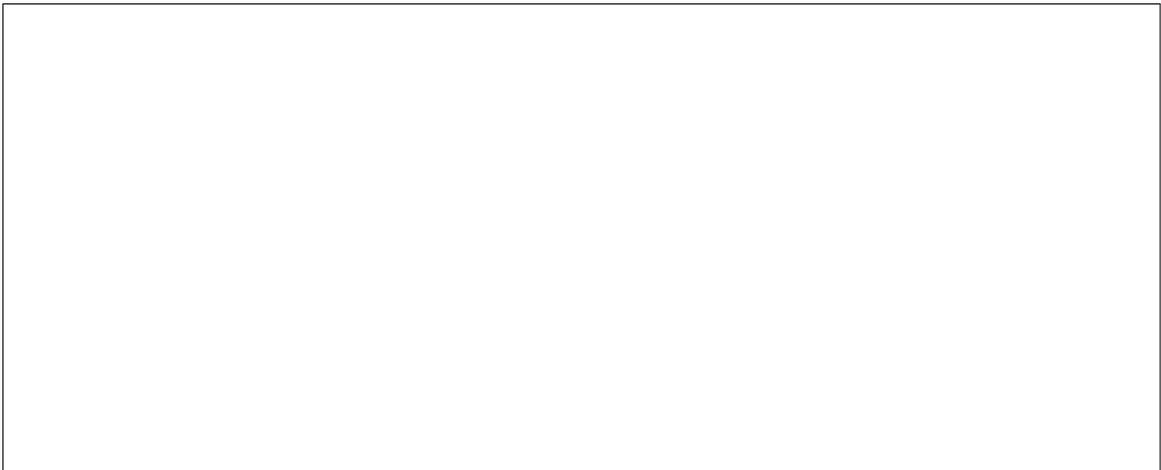
5.

Let A and B be events with $\mathbb{P}(A) > 0$ and $\mathbb{P}(B) > 0$.

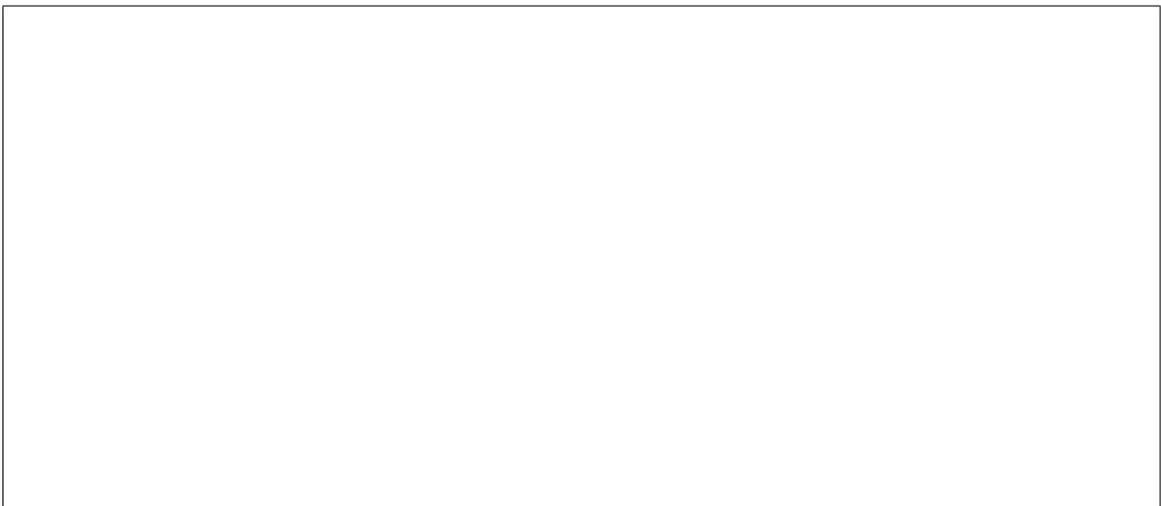
i) Define $\mathbb{P}(A|B)$.



ii) Determine $P(A|B)$ in the case that A and B are disjoint (mutually exclusive).



iii) Determine $P(A|B)$ in the case that B is a subset of A .



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