QUEEN MARY, UNIVERSITY OF LONDON

MAS 108 Probability I

Assignment 1 For handing in on 3 October 2005

Write your name and student number at the top of your assignment before handing it in. Staple all the pages together. Post the assignment in the red post-box on the ground floor of the Maths building before 1600 on Monday.

This week's reading: Devore, Chapter 2, Sections 2.1 and 2.2; *or* Hines and Montgomery, Chapter 2, Sections 2.1–2.4; *or* Rice, Chapter 1, Sections 1.1 and 1.2.

1 (15 marks) You throw an ordinary six-sided die, whose faces bear the numbers $1,\ldots,6$, and note what number is showing. Then you throw it again, and note what number is showing. (So you have written down two numbers.)

Write down the sample space, explaining your notation carefully.

How many elements are there in the sample space?

2 (15 marks) I have four pens in my satchel: one is red, one blue, one green and one black. I take one pen out of the satchel and lay it on the desk. Then I take another pen out of the satchel and lay it down to the right of the first one.

Write down the sample space, explaining your notation carefully.

How many elements are in the sample space $\mathcal{S}$?

3 (20 marks) For the sample space in Question 2, let J and K be the following events:

$$\begin{aligned} J &= \text{“the first pen is blue”} \\ K &= \text{“at least one of the pens on the desk is green”.} \end{aligned}$$

(a) Write down J, K and $J \cap K$ as subsets of $\mathcal{S}$.

(b) Assuming that all outcomes are equally likely, find $P(J)$, $P(K)$ and $P(J \cap K)$.

(c) Explain the event K' in words.

4 (10 marks) You arrive at the bus stop to wait for a bus. You will wait no longer than ten minutes for the bus; if it has not arrived after ten minutes, you will leave. The experiment consists of recording, to the nearest minute, how much time passes

between your arrival at the bus stop and the bus coming; if no bus comes, then you record "X".

Write down the sample space, explaining your notation carefully.

What is $|\mathcal{S}|$?

5 (10 marks) A couple wants two girls. They decide to keep having children and stop *either* when they have two girls *or* when they have four children, whichever happens first.

Ignoring the possibliity of twins, or other multiple births, write down the sample space.

6 (20 marks) For the sample space in Question 5, let E and F be the following events:

$$\begin{aligned} E &= \text{"there are at least two boys"} \\ F &= \text{"there are more boys than girls"} \end{aligned}$$

(a) Write down E, F and $E \cup F$ as subsets of $\mathcal{S}$.

(b) Assuming that all outcomes are equally likely, find $P(E)$, $P(F)$ and $P(E \cup F)$.

(c) Is this assumption reasonable? Why?

7 (10 marks) The experiment consists of waiting for the Eastbound number 25 bus outside Queen Mary on a weekday afternoon. Consider the following events:

$$\begin{aligned} A &= \text{"the first bus comes within 5 minutes"} \\ B &= \text{"the first bus comes within 10 minutes"} \\ C &= \text{"no bus comes within 5 minutes"} \\ D &= \text{"the first bus is too crowded to get on"} \end{aligned}$$

At least one of the following statements must be false. Choose a false statement and explain why it cannot be true.

(a) $P(A) = 3/4$, $P(D) = 3/4$ and $P(A \cap D) = 1/2$.

(b) $P(A) = 3/4$ and $P(B) = 1/2$.

(c) $P(A) = 3/4$ and $P(C) = 1/4$.