QUEEN MARY, UNIVERSITY OF LONDON

MAS 108 — Probability I

Assignment 7   **For handing in on 21 November 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 3, Sections 3.1–3.5 and Table A1; *or* Hines and Montgomery, Chapter 3, Sections 3.1, 3.3 and 3.5, and Chapter 4, Sections 4.3 and 4.5; and Chapter 6, Sections 6.2–6.4 and 6.7; *or* Rice, Chapter 2, Section 2.1, and Chapter 4, Sections 4.1–4.2, and Table 1. *Also* New Cambridge Statistical Tables, Table 1.

1 (30 marks) Let U, V, Y, Z be random variables such that $U \sim \text{Bin}(20, \frac{1}{5})$, $V \sim \text{Bernoulli}(\frac{2}{3})$, $Y = U + 7$ and $Z = -3V$. Write down the mean and variance of U, V, Y and Z.

2 (10 marks) Use tables to find

(a) $P(X \leq 6)$ when $X \sim \text{Bin}(15, 0.4)$;

(b) $P(Y \geq 13)$ when $Y \sim \text{Bin}(20, 0.7)$.

3 (15 marks) The Students' Union Shop sells packets of breakfast cereal containing signed photographs of the four first-semester Mathematics lecturers, Professor Bailey, Dr Nelson, Dr Soicher and Professor Tavakol. Each packet contains one photograph, and photographs are put in packets at random. Let N be the number of packets that you have to buy to get your first photograph of Dr. Nelson. Find $E(N)$ and $\text{Var}(N)$.

4 (20 marks) Let X be a random variable which takes the values x_1, x_2, x_3 with probabilities p_1, p_2 and p_3. Suppose that $x_1 < x_2 < x_3$. Prove that $E(X) \leq x_3$.

5 (25 marks) Read the following quotation:

> In Britain 55% of the workforce is male, 45% female. Nine in ten of those men (91%) work full time, but only just over half the women (55%). That is, half of the full-time workforce is male, only a quarter is female.

> From *Why men don't iron* by Anne and Bill Moir.

(a) What is wrong with the above?

(b) Given that 55% of the workforce is male, and that 91% of employed men and 55% of employed women work full-time, what proportion of the full-time workforce is male and what proportion is female?

(c) Can you suggest what mistake the authors may have made to come to the conclusion they did?