MAS187 Assignment 1

Deadline
4.30pm, Monday 12th December 2005. Work not handed in by this deadline might not be marked.

Presentation
Your work must be typed (font size 12) and be no longer than 5 sides of A4. Hand-drawn graphs and other diagrams are acceptable.

Marking
The assignment will be marked out of 20, including 5 marks for presentation (good English, brief clear answers, layout, neatness).

Submission procedure
Take your solutions to the Maths & Stats General Office, 5th Floor, Merz Court. Go to the window of the General Office and tell the secretaries that you want to hand in a project. They will give you a sheet to fill out. Once you have done this, you should attach the sheet to your work and hand it in at the General Office. You will then be given a receipt as proof that you handed in the assignment.

1. Changes in financial support for students in recent years have caused controversy. Suppose we want to investigate whether there is financial hardship, and, if so, how much, among students. Discuss briefly how we might use a survey to do this.

   - Suggest a target population. Who, exactly, are the "students" in question?
   - What kind of sampling should we use?
     - Stratified?
     - Cluster?
     - Multi-stage?

     Suggest a choice of sampling method and comment on why you have made this choice.
   - Comment on the extent to which we will be able to draw any conclusions about whether potential students are deterred from starting courses because of the changes.

2. The data in table 1 are based on job advertisements in a national newspaper for jobs in "Creative, Media and Marketing." They are salaries in £. Where a range of salaries was given, the midpoint is given here. Plot a histogram of the data, calculate the sample mean and the sample median and comment briefly on the distribution of salaries.

   The data may be obtained from the web page.

35406	84000	37560	31446	26358	75000	45910	26000	27000
26000	22000	25000	26000	21000	24570	26000	32000	30000
27888	47920	22778	25174	34000	18000	27592	45916	21500
27104	42000	36490	38716	44000	24000	33640	35418	46130
37386	28944	24000	40000	37800	28962	70000	36000	60000
25096	34096	26698	24000	45800	26880	35148	44298	35094
19000	50000	31446	24600	21500	22000	38000	27000	64000
35566	33200	36000	22812	46000	30758	42916	42524	40000

Table 1: Salaries in "Creative, Media and Marketing" jobs

3. The data in table 2 are taken from the results of a survey and give the household expenditure of twenty single men and twenty single women on four commodity groups. The units of expenditure are Hong Kong dollars and the commodity groups are as follows.

   1 Housing, including fuel and light.

   2 Foodstuffs, including alcohol and tobacco.

   3 Other goods, including clothing, footwear and durable goods.

   4 Services, including transport and vehicles.

   The data may be obtained from the web page.

   (a) For each commodity group and for both men and women separately, calculate the sample mean and sample standard deviation of the expenditures.

   (b) Use box-and-whisker plots to compare the expenditures of men and women for each of the four commodity groups.

   (c) Calculate the total expenditure for the men and for the women for each commodity group and use pie charts to compare these totals, as proportions of the total expenditure over all four groups, between men and women.

   (d) Comment on your results, especially the comparison between the men and the women.

4. Suppose that you buy a new washing machine and that you are offered the chance to buy an extended warranty to cover the cost of repairs to the machine. The warranty costs £30 and covers the cost of all repairs for a fixed period. You assess the probabilities for needing repairs as follows. There are only three types of repair: "New programmer", "New motor" and "Other."

   - The probability that the machine needs a new programmer is 0.1.
   - The conditional probability that the machine needs a new motor given that it needs a new programmer is 0.2.
   - The conditional probability that the machine needs a new motor given that it does not need a new programmer is 0.05.
   - The probability of needing an "Other" repair depends on whether a new motor is needed but, given whether or not a new motor is needed, it does not depend on whether a new programmer is needed.

Single men					Single women				
	Commodity group					Commodity group			
Household	1	2	3	4	Household	1	2	3	4
M1	497	591	153	291	W1	820	114	183	154
M2	839	942	302	365	W2	184	74	6	20
M3	798	1308	668	584	W3	921	66	1686	455
M4	892	842	287	395	W4	488	80	103	115
M5	1585	781	2476	1740	W5	721	83	176	104
M6	755	764	428	438	W6	614	55	441	193
M7	388	655	153	233	W7	801	56	357	214
M8	617	879	757	719	W8	396	59	61	80
M9	248	438	22	65	W9	864	65	1618	352
M10	1641	440	6471	2063	W10	845	64	1935	414
M11	1180	1243	768	813	W11	404	97	33	47
M12	619	684	99	204	W12	781	47	1906	452
M13	253	422	15	48	W13	457	103	136	108
M14	661	739	71	188	W14	1029	71	244	189
M15	1981	869	1489	1032	W15	1047	90	653	298
M16	1746	746	2662	1594	W16	552	91	185	158
M17	1865	915	5184	1767	W17	718	104	583	304
M18	238	522	29	75	W18	495	114	65	74
M19	1199	1095	261	344	W19	382	77	230	147
M20	1524	964	1739	1410	W20	1090	59	313	177

Table 2: Household expenditures

- The conditional probability that an “Other” repair is needed given that a new motor is needed is 0.1.
- The conditional probability that an “Other” repair is needed given that a new motor is not needed is 0.03.
- For the purpose of this question, assume that a repair of any one type can not occur more than once in the warranty period.

The costs of repairs are as follows.

- A new programmer costs £100.
- A new motor costs £140.
- An “Other” repair costs £80.

Using a probability tree, or otherwise, and on the basis of expected monetary value, determine whether you should buy the extended warranty.