**Crown Institute of Higher Education**

BUS104

Week 3 - workshop discussion/practice questions

 **Introduction to Probability**

A market research firm, interested in investigating the relationship between the ability of the consumer to recall a television commercial for a particular product and the actual purchase of the product, conducted a survey of 800 people. The responses to the survey revealed that 400 people could recall seeing the commercial and that 320 people actually bought the product. Of the people that bought the product, 240 could recall seeing the commercial.

1. Using the alphabetic characters B and R to represent the events “buying the product” and “recalling seeing the commercial” respectively, construct a 2x2 contingency/cross tabulation table to summarise the findings of the survey.

2. If the information revealed by the survey is typical of the population as a whole, determine the probability of selecting a person at random, from the population, who;

(a) had bought the product.

(b) could recall seeing the commercial.

(c) could recall seeing the commercial and bought the product.

(d) could recall seeing the commercial or bought the product.

**Note: In determining the probabilities in (c) and (d) there is no need to resort to the use of the general “and” or “or” probability rules introduced in lectures since they can be more easily obtained directly from the contingency table constructed in Q1. In expressing your answers to each of these probability determinations use appropriate probability notation and give your answers in fractional, decimal and percentage form.**

3. What is the probability that a person who could recall seeing the television commercial actually bought the product?

**Hint: You are being asked here to determine a conditional probability, in particular, the probability that a person bought the product given (“conditional on” or “if”) the person could recall seeing the commercial (in symbolic terms, P(B|R)). Once again the simplest way to obtain this probability is to determine it directly from the contingency table i.e. no need to use the conditional probability rule introduced to you in lectures.**

4. Although you have been advised not to use the probability rules in Q2 and 3 (simply because in these instance it is unnecessary to do so), there are situations where these rules are useful (and sometimes unavoidably necessary). Hence a working knowledge of their existence and faith in their validity is important.

Use probabilities obtained from the contingency table to verify the Complement Rule, the General Addition (“or”) Rule and the Conditional Probability Rule i.e.,

P(A) + P(A’) = 1

P(A or B) = P(A) + P(B) – P(A and B)

P(A|B) = P(A and B)/P(B)

You may do this in this particular application by verifying, for example, that;

P(B) + P(B’) = 1

P(R or B) = P(R) + P(B) – P(R and B)

P(B|R) = P(B and R)/P(R)

**Note that almost all of the probabilities referred to in these three statements have already been determined in Q2 and 3.**

5. Define what is meant by the term “mutually exclusive events”. Are the events "buying the product" and "recalling the commercial" mutually exclusive? Provide a brief explanation of the reasoning behind your answer by direct reference to a cell entry in the contingency table obtained in Q1.

**Note: An alternative explanation of mutual exclusivity (or not) involving reference to a probability value from Q2 is available to us in this instance. Which probability value? Why?**

6. Define what is meant by the term “independent events”. Are the events "buying the product" and "recalling the commercial" independent? Use probability values obtained in Q2 and/or 3 to justify your answer.

**Hint: There a two ways of doing this. You could make direct use of the Rule for Statistical Independence or, alternatively, you could use the special case of the Multiplication (“and”) Rule that applies for independent events. The first of these is the preferred option because it should make intuitive sense. The second method, in fact, is a mathematical extension of the first. Familiarise yourself with both for the sake of completeness.**

7. Most students of elementary probability are initially confused by the two ideas of mutually exclusive and independent events. They often mix them up or, in fact, think they are the same thing. In Q5 and 6 your understanding of these two types of special events should have been clarified. Just to make sure, reiterate the differences between them in two brief, succinct statements.

8. By comparing the relative magnitudes of P(B|R) and P(B) comment on the value of the commercial.

**Hint: In order to answer this question you need to think about what each of the situations, P(B|R) > P(B), P(B|R) < P(B) and P(B|R) = P(B), implies about this particular application.**