MATH 323 - ASSIGNMENT 1

Please submit your assignment by 11.59 pm on Friday 28th September by uploading a pdf to myCourses.

1. Consider two events A and B in sample space S, and suppose $P(A) = p_A$, $P(B) = p_B$.

   (a) Find the largest number l_1 and the smallest number u_1 such that
   $$l_1 \leq P(A \cap B) \leq u_1.$$
   3 MARKS

   (b) Find the largest number l_2 and the smallest number u_2 such that
   $$l_2 \leq P(A \cup B) \leq u_2.$$
   3 MARKS

   Leave your answers in terms of p_A and p_B.

2. Three newspapers, denoted A, B and C are published in a city. A comprehensive survey indicates that amongst the adult population of the city, 20% read A, 16% read B and 14% read C, but the survey also reveals that 8% read both A and B, 5% read both A and C, and 4% read both B and C, and that 2% read all three newspapers. A person is selected at random from the adult population of the city (that is, all adults are equally likely to be selected).

   Use formal notation to express the following events in terms of A, B, C, and find their probabilities.

   (a) the selected person reads none of the newspapers; 2 MARKS

   (b) the selected person reads precisely one of the newspapers 2 MARKS

   (c) the selected person reads at least A and B, **given** that they read at least one newspaper.
   4 MARKS

   Hint: it might help to imagine a city of 100000 adults.

3. (a) Eighteen students enrol in a course in which the Professor utilizes the following novel method of evaluation. Eighteen balls are placed in a bag: one is black, the other seventeen are red. Students are each to select one ball from the bag, without replacement. The student who selects the black ball will receive an A, all other students will receive a B.

   If a student prefers a higher grade to a lower grade, should they prefer to select first, fifth or eighteenth in the sequence of selections ? 3 MARKS

   (b) After complaints, the Professor agrees to modify the method of evaluation in (a), and does so by replacing one red ball by another black ball, with the concession of awarding As to each of the two students who select a black ball, with the other students receiving Bs.

   Under the new method of evaluation, should a student prefer to select first, fifth or eighteenth ?
   3 MARKS

   Justify your solutions using probability calculations. Assume that on any single selection, all balls are equally likely to be chosen from those remaining.