Godalming College

Statistics 14 – Hypothesis Testing

Please **complete** this homework by _____. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop in session.

Section 1 – Review of previous topics. Please complete all questions.

1. A jar contains 2 red, 1 blue and 1 green bead. Two beads are drawn at random from the jar without replacement.

   (a) Draw a tree diagram to illustrate all the possible outcomes and associated probabilities. State your probabilities clearly.

   (b) Find the probability that a blue bead and a green bead are drawn from the jar.

2. A person's blood group is determined by whether or not it contains any of 3 substances *A*, *B* and *C*.
   A doctor surveyed 300 patients' blood and produced the table below.

Blood contains	No. of Patients
only *C*	100
A and *C* but not *B*	100
only *A*	30
B and *C* but not *A*	25
only *B*	12
A, *B* and *C*	10
A and *B* but not *C*	3

   (a) Draw a Venn diagram to represent this information.

   (b) Find the probability that a randomly chosen patient's blood contains substance *C*.

   Patients whose blood contains none of these substances are called universal blood donors.

   (c) Find the probability that a randomly chosen patient is a universal blood donor.

Section 2 – Consolidation of this week's topic. Please complete all questions.

1. A market stall sells 15 packs of birthday cards an hour. The probability of selling cards to a passing customer is 0.68. The owner decides to change the packaging to see if this has a difference to the amount he sells.
   (a) Write down a suitable null and alternative hypothesis.
   (b) State whether this is a 1-tail or 2-tail test. **(3 marks)**

2. Carry out the following tests using the binomial distribution with a 5% significance level, where the random variable *X* represents the number of successes.
   a) $H_0: p = 0.25;\ H_1: p > 0.25;\ \ n = 10,\ x = 5$ **(2 marks)**
   b) $H_0: p = 0.40;\ H_1: p < 0.40;\ \ n = 10,\ x = 1$ **(2 marks)**

3. Michelle reads a newspaper article stating that it rained on 30% of days in Cambourne in 2015. Michelle lives in Cambourne and is convinced it rained more than this, and so takes a random sample of 20 days from the large data set. From her sample she finds that there is at least a trace of rain on ten of these days. Carry out a hypothesis test at the 5% level of significance to determine if her view is supported. **(4 marks)**

4. A gardener knows from experience that 45% of petunia seeds produce a plant when sown. After an infestation of slugs she predicts that she will be less successful with her petunia plants than usual. From 20 seeds sown, 3 plant successfully. Test, at the 1% level of significance, the gardener's prediction. State your hypotheses clearly. **(4 marks)**

5. A biologist is investigating the gender of new born kittens and predicts the number of males and females will not be equal. She investigates the next 20 kittens born and finds that 7 of them are female. Carry out a 5% hypothesis test. **(5 marks)**

6. Charles buys a special coin that claims to have been made so that the probability of it landing on a tail is 0.6. He suspects that it has been made incorrectly, and so flips the coin 50 times. It lands on a tail on 37 occasions. Carry out a 5% hypothesis test to see if Charles; suspicions are supported. **(5 marks)**

(Total 25 marks)

Section 3 – Extension questions. If you are aiming for a top grade, you should attempt these questions.

1. Over a long period of time it has been found that in a local restaurant the ratio of non-vegetarian to vegetarian meals is 3 to 1.
   During one particular day in the restaurant, a random sample of 20 people contained 2 who ordered a vegetarian meal. Abdul wants to use a hypothesis test to show that the proportion of vegetarian meals ordered that day is lower than usual. Find, to the nearest integer, the smallest significance level that he should use.