KINGSWAY CHRISTIAN COLLEGE

MATHS DEPARTMENT5

Course: Mathematics Methods Year 12

Assessment Task: Test 5 – Discreet Random Variables and The Binomial Distribution

Student Name: _____

Date: 10 & 11th August 2017

Assessment Score: _____ / 45

Year Score: _____

Comments: _____

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Teacher signature: _____

Parent/ Guardian signature:

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Comments: _____

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METHODS YEAR 12 Test 5 2017
Discreet Random variables and Distributions

Calculator Allowed **Time: 45 mins** **Marks: / 45**

Calculators are allowed for this test, but no notes. Please show work out where needed.

Question 1 **(3,4,3 = 10 marks)**

The discrete random variable X can only take the values 0, 1, 2, 3, 4, 5. The probability distribution of X is given by the following

$$P(X=0)=P(X=1)=P(X=2)=a$$
$$P(X=3)=P(X=4)=P(X=5)=b$$
$$P(X\geq 2)=3P(X<2)$$

where a and b are constants.

(a) Determine the values of a and b.

(b) Show that the expectation of X is $\frac{23}{8}$ and determine the exact variance of X.

EXTRA WORKING

(c) Determine the exact probability that the sum of two independent observations from this distribution exceeds 7.

Question 2 **(3,2,2,3= 10 marks)**

On a long train journey, a statistician is invited by a gambler to play a dice game. The game uses two ordinary dice which the statistician is to throw.

If the total score is 12, the statistician is paid \$6 by the gambler. If the total score is 8, the statistician is paid \$3 by the gambler. However, if both or either dice show a 1, the statistician pays the gambler \$2. Otherwise, no money changes hands.

Let \$ X be the amount paid to the statistician by the gambler.

(a) Complete the table below.

x		0	3	6
$P(X = x)$				

Question 6 **(3,2,2,2 = 9 marks)**

A manufacturer of hockey gloves produces 4 times as many left-handed gloves as right-handed ones. The gloves are randomly packed in boxes of 100.

Let the Discreet Random Variable X = the number of right handed gloves per box.

(a) Find the probability that in a box there are

(i) an equal number of left-handed and right-handed gloves

(ii) at least 30 right-handed gloves.

(iii) fewer than 20 right-handed gloves .

(b) A random sample of 8 boxes is taken from the production line. Use your answer from question (iii), to find the probability that exactly 5 of the boxes contain fewer than 20 right-handed gloves.
Let the Discreet Random Variable Y= the number of boxes that contain fewer than 20 right-handed gloves.

(b) Explain why the table in part (a) describes a probability distribution for the discrete random variable X .

(c) Show that, if the statistician played the game 100 times, his expected loss would be $2.78, to the nearest cent.

(d) Find the amount, $\$a$, that the $6 would have to be changed to in order to make the game unbiased.

Question 3 **(3 marks)**

Given that $X \sim B(15, p)$ find the value of p such that $P(X > 13) = 0.4$

Show your working

Question 4 **(2,4 = 6 marks)**

In a school of 480 students, 25% said they barracked for the Dockers.

(a) State why " Supported the Dockers" is a Binomial random variable in this context.

(b) Determine μ and σ.

Question 5 **(1,3,1,2 = 7 marks)**

A Study found that 75 per cent of people exhibiting common influenza symptoms recovered without taking any medication. A random sample of 20 people who had developed influenza symptoms was taken.

Let X denote the number of people in this sample who recovered without taking any medication.

(a) State why X is classified as discrete and not continuous?

(b) State the probability distribution of X and the mean and standard deviation of this distribution.

(c) What is the probability, correct to three decimal places that

(i) Exactly 16 people recovered without any medication?

(ii) At least 13 but no more than 16 recovered without any medication?