NAME

**Eastern Goldfields College**

**Mathematics Methods U3&4 Test 4 – 2018**

**Calculator Free**

Reading Time: 2 minutes Working Time: 17 minutes Marks: 17

Question 1 (5 marks)

Determine if each of the following is a Discrete Random variable. If not, give a reason.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *x* | 1 | 2 | 3 | 4 | 5 | 6 |
| P(*X* = *x*) |  |  |  |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *x* | -3 | -2 | -1 | 0 | 1 | 2 |
| P(*X* = *x*) | 0.3 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 |

b)

1. P(X = x) =  where X = 0,1,2,3

Question 2 (6 marks)

The discrete random variable X has the probability distribution shown in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 0 | 1 | 2 | 3 |
|  |  |  |  |  |

Determine the value of the constant a.

Question 3 (6 marks)

A box contains five balls numbered and . Three balls are randomly drawn from the box at the same time and the random variable is the largest of the three numbers drawn.

a) By listing all possible outcomes (, , etc.), determine . (2 marks)

b) Construct a table to show the probability distribution of . (2 marks)

c) Calculate . (2 marks)

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**Calculator Assumed**

Reading Time: 3 minutes Working Time: 36 minutes Marks: 36

Question 4 (7 marks)

a) Determine the mean of a Bernoulli distribution with variance of 0.24. (3 marks)

b) A Bernoulli trial, with probability of success p, is repeated n times. The resulting distribution of the number of successes has an expected value of 5.76 and a standard deviation of 1.92. Determine n and p. (4 marks)

Question 4 (6 marks)

of the fish in a large inland lake are known to be trout. Eight fish are caught at random from the lake every day.

a) Describe, with parameters, a suitable probability distribution to model the number of trout in a day's catch. (2 marks)

b) Determine the probability that there are fewer trout than fish of other species in a day's catch. (2 marks)

c) Calculate the probability that over two consecutive days, a total of exactly trout are caught. (2 marks)

Question 5 (8 marks)

A fairground shooting range charges customers to take shots at a target. A prize of is awarded if a customer hits the target twice and a prize of is awarded if a customer hits the target more than twice. Otherwise no prize money is paid.

Assume that successive shots made by a customer are independent and hit the target with the probability .

a) Calculate the probability that the next customer to buy shots wins

(i) a prize of . (2 marks)

(ii) a prize of . (1 mark)

b) Calculate the expected profit made by the shooting range from the next customers who pay for shots at the target. (3 marks)

1. Determine the probability that less than out of the next customers will not win a prize.

(2 marks)

Question 6 (8 marks)

The discrete random variable has a mean of and the following probability distribution.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

a) Determine the values of the constants and . (3 marks)

b) Determine . (2 marks)

c) Determine

(i) . (1 mark)

(ii) . (1 mark)

(iii) . (1 mark)

Question 7 (7 marks)

A random sample of components are selected at random from a factory production line. The proportion of components that are defective is and the probability that a component is defective is independent of the condition of any other component.

The random variable is the number of faulty components in the sample. The mean and standard deviation of are and respectively.

a) Determine the values of and . (4 marks)

b) After changes are made to the manufacturing process, the proportion of defective components is now . Determine the smallest sample size required to ensure that the probability that the sample contains at least one defective component is at least .

(3 marks)