JUNE 2013

A bank has an ATM (Automated Teller Machine) which customers can use to withdraw cash. Withdrawals can be made in fixed amounts, £X. The table shows the amounts available and the probability distribution for X.

x	$P(X=x)$
10	0.18
20	0.44
50	0.13
100	0.08
200	0.17

(a) (i) Find the value of $E(X)$. *(2 marks)*

(ii) Show that the standard deviation of X is 68.0, correct to three significant figures. *(3 marks)*

(iii) Find the probability that at least one out of a random sample of three customers withdraws more than the mean amount of cash. *(3 marks)*

(b) The bank is considering making an additional amount of £300 available. It is expected that some of the customers who currently withdraw £200 would then withdraw £300.

State whether this change would increase, decrease or leave unchanged:

(i) the mean of X;

(ii) the standard deviation of X. *(2 marks)*

(c) A small number of customers use the ATM to see the balance in their account and do not withdraw any cash. If the table were changed to include these customers, **explain why** this would decrease the mean of X. *(2 marks)*

JUNE 2011

In a pay-and-display car park, users are charged different amounts according to the lengths of time they wish to park their cars. The following table shows the distribution of the amounts, X pence, paid by users.

x	$P(X=x)$
100	0.22
200	0.31
300	0.21
400	0.12
600	0.14

(a) (i) Show that the mean of X is 279.

(ii) Find the standard deviation of X. *(4 marks)*

(b) A small proportion of the cars in the car park belong to employees of the firm which operates the car park, who are allowed to park their cars with no charge. If these employees were included as users, state, giving a reason, whether the standard deviation would increase, stay the same or decrease. *(2 marks)*

(c) In fact, there is no charge for cars entering the car park after 6 pm. In the evening, it is used by a large number of people going to a nearby cinema. At 9 pm, a few cars which have been parked before 6 pm remain in the car park, but nearly all the cars in the car park have parked with no charge.

State, giving a reason, whether the standard deviation of the amounts paid to park the cars which are in the car park at 9 pm is greater than, the same as or less than the standard deviation of X. *(2 marks)*

JAN 2012

A restaurant offers fresh lobster on its menu. On each lobster sold, the restaurant makes a profit of £24. On each lobster unsold at the end of the day, it makes a loss of £16. At present, the manager buys **four** lobsters each day. Past experience has shown that the number of lobsters, X, requested daily by customers follows the distribution shown in **Table 1**.

Table 1

x	0	1	2	3	4
$P(X=x)$	0.1	0.15	0.25	0.35	0.15

(a) (i) Show that the mean value of X is 2.3, and calculate the standard deviation of X. *(4 marks)*

(ii) Use this mean value of X and the corresponding mean value of lobsters unsold to show that the restaurant's mean daily profit on lobsters is £28. *(2 marks)*

(b) The manager considers reducing the number of lobsters that she buys each day to three. Assuming that the distribution of the number of lobsters requested daily by customers stays the same, **Table 2** shows the distribution of the number of lobsters, Y, **sold** daily under this new arrangement.

Table 2

y	0	1	2	3
$P(Y=y)$	0.1	0.15	0.25	k

(i) State the value of k. *(1 mark)*

(ii) Calculate the mean daily profit from the lobsters when the manager buys only three each day. *(3 marks)*

(iii) Give one advantage of the manager reducing the number of lobsters that she buys to three each day. *(1 mark)*

(iv) Give one disadvantage of the manager reducing the number of lobsters that she buys to three each day. *(1 mark)*

JUNE 2015

Every Saturday evening, Angus runs a disco at the village hall. The hall must be tidied and cleaned on the morning of the following day, Sunday. This is done by Angus and a variable number of volunteers.

Angus keeps a record of the number of volunteers, X, and the probability distribution for X is given in the table.

x	0	1	2	3	4	5	6 or more
$P(X=x)$	p	0.15	0.20	0.21	0.18	0.14	0

(a) (i) Find the value of p.

(ii) Interpret the implication for Angus of this value of p. **[2 marks]**

(b) Find the mean value of X and show that, correct to three significant figures, the standard deviation of X is 1.57. **[5 marks]**

The Discrete Uniform Distribution

The discrete uniform distribution, when drawn out looks like this:

The Discrete Uniform Distribution occurs when the probability of each outcome is

____

If a Discrete Uniform Distribution has ***n*** outcomes the probability of each outcome is

____

The Uniform Distribution is sometimes known as the rectangular distribution because

____

____

When the values are evenly spaced, you can find the mean and median by:

-
-

Definition

A discrete random variable is defined as any event subject to ____ when a list can be made of the possible outcomes

The Continuous Uniform Distribution

NOTE THAT …

The Uniform Distribution can be used for both discrete and continuous data. These characteristics of the discrete uniform distribution DO NOT always apply for the continuous uniform distribution as well

Notation

P(X = x) means the probability that the random variable 'X' takes the value 'x'

P(X ≠ x) means the probability that the random variable 'X' does not take the value 'x'

P(X < x) means the probability that the random variable 'X' is less than the value 'x'

P(X > x) means the probability that the random variable 'X' is greater than the value 'x'

P(X ≤ x) means the probability that the random variable 'X' is less than or equal to the value 'x'

P(X ≥ x) means the probability that the random variable 'X' is more than or equal to the value 'x'

DISCRETE RANDOM VARIABLES

Revision Mat

Activity

P(X = x) = 0.32 means

P(X ≠ x) = 0.06 means

P(X < x) = 0.87 means

P(X > x) = 0.54 means

P(X ≤ x) = 0.19 means

P(X ≥ x) = 0.73 means

P(X = x)= $\begin{cases} 1/3 & x = 1,2,3 \\ 0 & otherwise \end{cases}$ means

Expectation and Variance

A random variable is a variable whose value is (within limits) determined by ____

The mean of a discrete random variable X is also known as the ______________________________________ of a discrete random variable X is denoted as:

This can be 'shown' by multiplying each x value by its _________________________________ and adding up the results or simply using the calculator for mean where the frequency is the ___________________________

The variance of a discrete random variable X is denoted by:

Where E(X^2) is calculated by multiplying each x value by ______________________________________ and then it's ____

The mode of a discrete random variable is the observation with the _______________________________________ probability

The median of a discrete random variable is where the probability of ____________________ would lie if we calculated P(X < x)

REMEMBER:

$E(X)^2 \neq E(X^2)$