PROBABILITY SAMPLING DISTRIBUTIONS

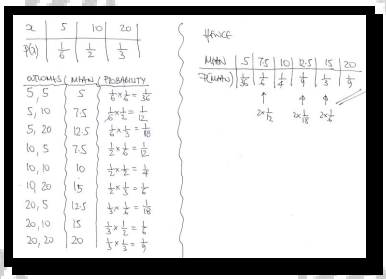
Question 1 (***)

A bag contains a **large** number of coins. Half of the coins are 10 pence pieces, one third are 20 pence pieces and the rest are 5 pence pieces.

A sample of two coins is selected at random.

Determine the sampling distribution of the mean of the two coins.

mean	5	7.5	10	12.5	15	20
$\mathrm{P}(\text{mean})$	$\frac{1}{36}$	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{1}{9}$	$\frac{1}{3}$	$\frac{1}{9}$



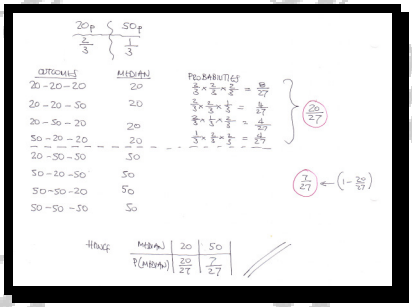
Question 2 (***)

A bag contains a **large** number of coins. Two thirds of the coins are 20 pence pieces and the rest are 50 pence pieces.

A sample of three coins is selected at random.

Find the sampling distribution of the median of the three coins.

median	20	50
$\mathrm{P}(\text{median})$	$\frac{20}{27}$	$\frac{7}{27}$



Question 3 (***)

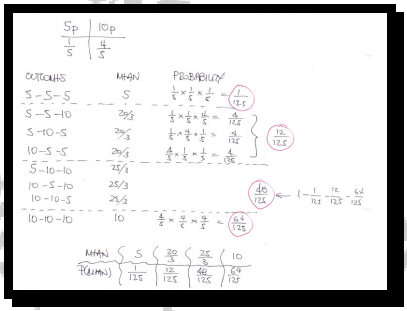
A bag contains a **large** number of coins, some 5 pence pieces and some 10 pence pieces.

The ratio of 5 pence pieces to the 10 pence pieces is $1:4$.

A sample of three coins is selected at random.

Find the sampling distribution of the mean of the three coins.

mean	5	$\frac{20}{3}$	$\frac{25}{3}$	10
$\mathrm{P}(\text{mean})$	$\frac{1}{125}$	$\frac{12}{125}$	$\frac{48}{125}$	$\frac{64}{125}$



Question 4 (***)

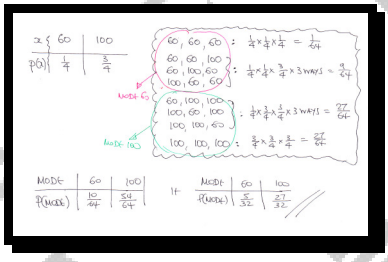
A **large** number of light bulbs are stored in the stock-room of an electrical shop.

The ratio of 60 watt bulbs to 100 watt bulbs is $1:3$.

A sample of three light bulbs is selected at random.

Find the sampling distribution of the mode of the three bulbs.

mode	60	100
$\mathrm{P}(\text{mode})$	$\frac{5}{32}$	$\frac{27}{32}$



Question 5 (***)

During hot days, an ice cream van sells a large number of ice cream cones containing either 1, 2 or 3 scoops of ice cream.

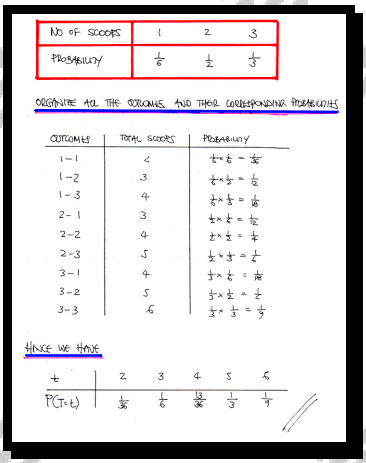
The respective probabilities of a customer buying a 1, 2 or 3 scoop ice cream cone are $\frac{1}{6}$, $\frac{1}{2}$ or $\frac{1}{3}$.

A random sample of 2 customers is examined, each customer having bought an ice cream cone from this van.

Determine the sampling distribution of T, where T represents the total number of scoops of ice cream bought by these 2 customers.

$\square$,

t	2	3	4	5	6
$\mathrm{P}(T=t)$	$\frac{1}{36}$	$\frac{6}{36}$	$\frac{13}{36}$	$\frac{12}{36}$	$\frac{4}{36}$



Question 6 (****)

A bag contains a large number of 5 pence coins and 10 pence coins.

There are twice as many 10 pence coins as there are 5 pence coins.

A random sample of size 2 is taken from the bag and the value of each coin is denoted as X_1 and X_2.

A statistic Y based on this sample is defined as

$$Y=\frac{1}{5}\left[3X_1+2X_2\right].$$

Determine the sampling distribution of Y and hence or otherwise find $\text{Var}(Y)$.

$$\boxed{},\ \boxed{\begin{array}{c|cccc} y & 5 & 7 & 8 & 10 \\ \hline \text{P}(Y=y) & \frac{1}{9} & \frac{2}{9} & \frac{2}{9} & \frac{4}{9} \end{array}},\ \boxed{\text{Var}(Y)=\frac{26}{9}}$$