# PROBABILITY SAMPLING DISTRIBUTIONS

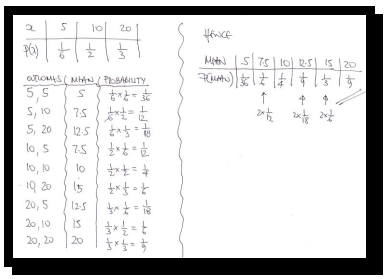
**Question 1 (***)**

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



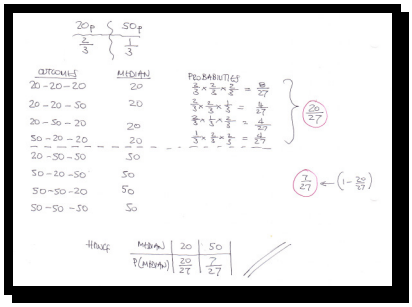
**Question 2 (***)**

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 (***)**

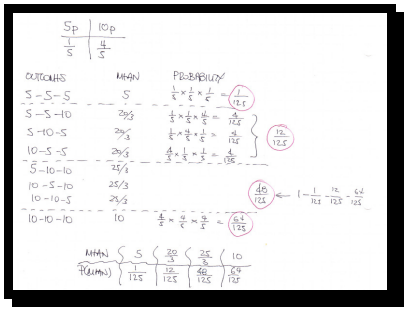
A bag contains a **large** number of coins, some $5$ pence pieces and some $10$ pence pieces.

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.

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



**Question 4 (***)**

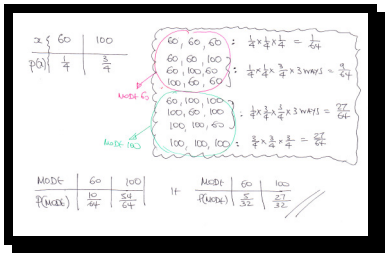
A **large** number of light bulbs are stored in the stock-room of an electrical shop.

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.

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



**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.

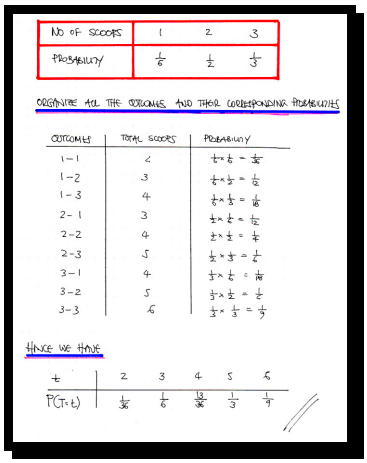
The respective probabilities of a customer buying a $1$, $2$ or $3$ scoop ice cream cone are $\frac{1}{6}$, $\frac{1}{2}$ or $\frac{1}{3}$.

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 $\text{Var}(Y)$.

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

