1 The probability that Kodjo and Adoga pass an examination are $p_1 = 0.43$ and $p_2 = 0.53$ respectively. Find the probability of both boys failing the examination.

2 Three balls are drawn from a box containing 6 red marbles, 4 white marbles and 5 blue marbles. Find the probability that they are drawn in the order: red, white, and blue if each ball is drawn with replacement.

3 When a die is thrown, what is the probability that the number is greater than 1, given that it is odd?

4 Giving that mean=34, median= 32 and standard deviation as 12. Calculate the Pearson's coefficient of skewness

5 Calculate the standard deviation of the marks: 2,3,6,2,5,0,4,2.

6 Find the mode of 3, 6, 10, 13, 14, 17, 19 and 22

7 Find the median of 3, 6, 10, 13, 14, 17, 19 and 22

8 calculate the arithmetic mean of 3, 6, 10, 13, 14, 17, 19 and 22

9 The data which has been collected for some other enquiry order than the one of immediate interest is called ……..

<div align="center">**Solution**</div>

1. If the probability that Kodjo and Adoga pass an examination are $p_1 = 0.43$ and $p_2 = 0.53$ respectively, then the probability that Kodjo and Adoga fail an examination are $q_1 = 1 - p_1 = 1 - 0.43 = 0.57$ and $q_2 = 1 - p_2 = 1 - 0.53 = 0.47$ respectively. Suppose that events "Kodjo passes an examination", "Adoga passes an examination" are independent, then events A="Kodjo passes an examination", B="Adoga passes an examination" are independent too.

   By multiplication rule, the probability of both boys failing the examination is

$$P(A \text{ and } B) = P(A)P(B) = q_1 q_2 = (1 - p_1)(1 - p_2) = 1 - (p_1 + p_2) + p_1 p_2 = (1 - 0.43)(1 - 0.53) = = 0.2679.$$

2. For the first draw, there is a total of 15 balls, 6 red plus 4 white plus 5 blue. You have a 6 in 15 chance of drawing a red ball. Dividing 6 by 15 gives you the probability of drawing a red ball. The probability that red marble is drawn at the first draw is

$$p_1 = \frac{6}{6 + 4 + 5} = \frac{6}{15} = \frac{2}{5}.$$

You then put that red ball back into the box. On the second draw you have a 4 in 15 chance of drawing a white ball. So the probability that white marble is drawn at the second draw is

$$p_2 = \frac{4}{6 + 4 + 5} = \frac{4}{15}.$$

You then put that white ball back into the box. On the third draw you have a 5 in 15 chance of drawing a blue ball. So the probability that blue marble is drawn at the third draw is

$$p_3 = \frac{5}{6+4+5} = \frac{5}{15}.$$

So, by the multiplication rule, the probability that they are drawn in the order: red, white, and blue if each ball is drawn with replacement is

$$P = p_1 p_2 p_3 = \frac{6}{15} \cdot \frac{4}{15} \cdot \frac{5}{15} = \frac{120}{3375} = \frac{2}{5} \cdot \frac{4}{15} \cdot \frac{1}{3} = \frac{8}{225} = 0.036$$

3.

Method 1

When a die is thrown, then possible outcomes are {1,2,3,4,5,6}. Outcomes, where the number is odd, are {1,3,5}. Outcomes, where the number is greater than 1 and it is odd are {3,5}.
Let $A = $ "*the number is greater than* 1", $B = $ "*the number is odd*".

By the definition of conditional probability, the probability that the number is greater than 1, given that it is odd, is calculated by

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{\frac{2}{6}}{\frac{3}{6}} = \frac{2}{3}$$

Method 2

Let possible outcomes be {1,3,5}, where the number is odd. Let favourable outcomes be {3,5}, where the number is greater than 1 and is odd.

Thus, the probability that the number is greater than 1, given that it is odd, is

$$P = \frac{2}{3}.$$

4. The Pearson's coefficient of skewness, which uses the median, is given by

$$3\frac{mean - median}{standard\ deviation} = 3\frac{34 - 32}{12} = \frac{3}{6} = \frac{1}{2} = 0.5$$

5. If marks are 2,3,6,2,5,0,4,2, then

$$\sum_{i=1}^{n} x_i = 2 + 3 + 6 + 2 + 5 + 0 + 4 + 2 = 24.$$

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{24}{8} = 3.$$

$$\sum_{i=1}^{n} x_i^2 = 2^2 + 3^2 + 6^2 + 2^2 + 5^2 + 0^2 + 4^2 + 2^2 = 98.$$

If marks represent the whole population, then the standard deviation is given by

$$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2} = \sqrt{\frac{1}{n}\left(\sum_{i=1}^{n} x_i^2\right) - \bar{x}^2} = \sqrt{\left(\frac{1}{n}\sum_{i=1}^{n} x_i^2\right) - \left(\frac{1}{n}\sum_{i=1}^{n} x_i\right)^2} = \sqrt{\frac{98}{8} - 3^2} = \frac{\sqrt{13}}{2} \approx 1.8.$$

In <u>Excel 2007</u> *the population* standard deviation is calculated via

=STDEVP(2;3;6;2;5;0;4;2).

In <u>Excel 2010</u> *the population* standard deviation is calculated via

=STDEV.P(2;3;6;2;5;0;4;2).

In <u>R language</u> *the population* standard deviation is calculated via

sd(c(2,3,6,2,5,0,4,2))*sqrt(7/8)

In expression sqrt(7/8) number 7 denotes the number of observations minus 1, number 8 denotes the number of observations.

If data is extracted from a sample, then the standard deviation is given by

$$\sigma = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2} = \sqrt{\frac{\sum_{i=1}^{n}x_i^2 - \frac{\left(\sum_{i=1}^{n}x_i\right)^2}{n}}{n-1}} = \sqrt{\frac{98 - \frac{24^2}{8}}{7}} = \sqrt{\frac{208}{56}} = \sqrt{\frac{26}{7}} \approx 1.9.$$

In <u>Excel 2007</u> *the sample* standard deviation is calculated via

=STDEV(2;3;6;2;5;0;4;2).

In <u>Excel 2010</u> *the sample* standard deviation is calculated via

=STDEV.S(2;3;6;2;5;0;4;2).

In <u>R language</u> *the sample* standard deviation is calculated via

sd(c(2,3,6,2,5,0,4,2))

6. The mode is the value that appears most often in a set of data.

This set of data 3, 6, 10, 13, 14, 17, 19, 22 doesn't have mode because any number occurs one time.

In <u>Excel 2007</u> the mode is calculated via

= MODE(3,6,10,13,14,17,19,22)

In <u>Excel 2010</u> the mode is calculated via

= MODE.SNGL(3,6,10,13,14,17,19,22)

In <u>R language</u> the function mode() tells you the internal storage mode of the R object, not the value that occurs the most in its argument. You should write functions in R language to calculate the mode

```
Mode<-function(x){

ux<-unique(x)

ux[which.max(tabulate(match(x,ux)))]

}
```

7. Observations $X_1 = 3$, $X_2 = 6$, $X_3 = 10$, $X_4 = 13$, $X_5 = 14$, $X_6 = 17$, $X_7 = 19$, $X_8 = 22$ are arranged in ascending order, the number of observations $n = 8$ is even.

Then the median is defined to be the value of $\left[\left(\frac{n}{2}\right)th\ item\ term + \left(\left(\frac{n}{2}\right)+1\right)th\ item\ term\right]/2$, that is,

$$\text{Median} = \frac{X_4 + X_5}{2} = \frac{13 + 14}{2} = 13.5.$$

In <u>Excel 2007, 2010</u> the median is calculated via

=MEDIAN(3;6;10;13;14;17;19;22)

In <u>R language</u> the median is calculated via

median(c(3,6,10,13,14,17,19,22))

8. The arithmetic mean of 3, 6, 10, 13, 14, 17, 19 and 22 is given by

$$\bar{x} = \frac{\sum x_i}{n} = \frac{3 + 6 + 10 + 13 + 14 + 17 + 19 + 22}{8} = 13.$$

In <u>Excel 2007, 2010</u> the arithmetic mean is calculated via

=AVERAGE(3;6;10;13;14;17;19;22)

In <u>R language</u> the arithmetic mean is calculated via

mean(c(3,6,10,13,14,17,19,22))

9. The data which has been collected for some other enquiry order than the one of immediate interest is called <u>Secondary data.</u>