Program

```
x <- choose (7,1); x
y <- choose (12,1); y
z <- choose (4,1); z
t <- choose (23,3); t
prob <- (x*y*z)/t; prob
```

Output

prob = 0.1897233

PRACTICAL SHEET - 06

PROBABILITY

1. A bag contains 7 red, 12 white, 4 blue balls. What is the probability that 3 balls are drawn, one of each color?

Solution:

Probability of drawing 3 balls, one of each colour

$$= \frac{{}^{7}C_1 \times {}^{12}C_1 \times {}^{4}C_1}{{}^{23}C_3}$$

$$= 0.1897$$

Activity

Program

```
PA <- choose(10,4)/choose(18,4); PA
PB <- choose(8,4)/choose(18,4); PB
probrept <- PA*PB ; probrept
PBA <- choose(8,4)/choose(14,4); PBA
probnorept <- PA*PBA ; probnorept
```

Output

probrept (probability when coins are replaced) = 0.001569909

probnorept (probability when coins are not replaced) = 0.004799122

2. A bag contains 10 gold and 8 silver coins. a successive drawings from coins are made such that the coins are

(i) replaced before the second draw

(ii) not replaced

Find the probability that the first drawing will give 4 gold and second drawing will give 4 silver

solution>

let A → drawing 4 gold, and B → drawing 4 silver

(i) If coins are replaced before second draw, then A and B are mutually exclusive events.

$\therefore P(A \cap B) = P(A) \cdot P(B)$

$= \frac{10C4}{10C4} \times \frac{3C4}{18C4}$

$= 0.0016$

(ii) If coins are not replaced

$P(A \cap B) = P(A) \cdot P(B/A)$ (not mutually exclusive)

$= \frac{10C4}{18C4} \times \frac{8C4}{14C4}$

$= 0.0048$

Program

```
PE1 <- 0.8 ; PE1
PE2 <- 0.2 ; PE2
PAG <- 0.85 ; PAE1
PAE2 <- 0.65 ; PAE2
PE1A <- (PAE1 * PE1)/(PAE1 * PE1 + PAE2 * PE2) ; PE1A
PE2A <- (PAE2 * PE2)/(PAE1 * PE1 + PAE2 * PE2) ; PE2A
```

output

```
PE1A (P(E1|A)) = 0.8395062
PE2A (P(E2|A)) = 0.1604938
```

3, A company has 2 plants to manufacture a scooter. Plant I manufactures 80% of the scooter and plant II manufacture 20%. At plant I, 85 out of 100 are noted standard quality is better. At plant II, 65 out of 100 are noted a standard quality or better. What is the probability that

(I) Scooter selected at random came from plant I if it is known that scooter is of standard quality?

(II) Scooter selected at random came from plant II, if it is known that scooter of standard quality?

solution > let $E_1 \rightarrow$ Scooter came from plant I

$E_2 \rightarrow$ Scooter came from plant II

$A \rightarrow$ Scooter is of standard quality

$P(E_1) = 0.8$, $P(E_2) = 0.2$, $P(A|E_1) = 0.85$ $P(A|E_2) = 0.65$

(I) Probability that scooter came from plant I given it is of standard quality, $P(E_1|A)$, by bayes theorem

$$P(E_1|A) = \frac{P(A|E_1) \cdot P(E_1)}{P(A|E_1)P(E_1) + P(A|E_2)P(E_2)} = 0.8395$$

(II) Probability that scooter came from plant II given it is of standard quality,

$$P(E_2/A) = \frac{P(A|E_2) \cdot P(E_2)}{P(A|E_1)P(E_1) + P(A|E_2) \cdot P(E_2)}$$

$= 0.16$

Program

```
PE1 <- 0.2;PE1
PE2 <- 0.6 ; PE2
PE3 <- 0.2 ; PE3
PAE1 <- choose(7,2)/choose(10,2) ; PAE1
PAE2 <- choose(4,2)/ choose(10,2); PAE2
PAE3 <- choose(2,2)/ choose(10,2) ; PAE3
PE3A <- (PAE3 * PE3)/(PAE1 * PE1 + PAE2 * PE2 + PAE3 * PE3); PE3A
```

Output

PE3A (P(E3/A)) = 0.025

4) The contents of 3 urns are as follows

urn 1: 7 white, 3 black balls

urn 2: 4 white, 6 black balls

urn 3: 2 white, 8 black balls

One of these urn is chosen at random with probabilities 0.2, 0.6, 0.2 from the chosen urn 2 balls are drawn at random without replacement. If both these balls are white, What is the probability that these are from urn 3?

solution>

$E_1 \rightarrow$ urn 1 are selected $\Rightarrow P(E_1) = 0.2$

$E_2 \rightarrow$ urn 2 are selected $\Rightarrow P(E_2) = 0.6$

$E_3 \rightarrow$ urn 3 are selected $\Rightarrow P(E_3) = 0.2$

$A \rightarrow$ both balls are selected white

$P(A|E_1) = 7C2/10C2 = 21/45$ $\quad$ $P(A|E_2) = 4C2/10C2 = 6/45$ $\quad$ $P(A|E_3) = \frac{2C2}{10C2} = 1/45$

Probability that balls are drawn from urn 3 give both balls are white, $P(E_3/A)$, by Baye's theorem

$$P(E_3/A) = \frac{P(A|E_3)P(E_3)}{P(A|E_1)P(E_1) + P(A|E_2)P(E_2) + P(A|E_3)P(E_3)}$$

$$= 0.02$$

5) A problem in statistics is given to students whose chance of solving the problem are 1/2, 1/2 and 1/3. What is the chance that the problem will be solved?

solution>

A → 1st student solves the problem

B → 2nd student solves the problem

C → 3rd student solves the problem

Probability that the problem is solved = $P(A \cup B \cup C)$

$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(AB) - P(BC) - P(AC) + P(ABC)$

$= \frac{1}{2} + \frac{1}{2} + \frac{1}{3} - \frac{1}{4} - \frac{1}{6} - \frac{1}{6} + \frac{1}{2}$

$= \underline{\underline{0.83}}$