CIND123 Winter 2018 - Assignment #2

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Use RStudio for this assignment. Edit the file `assignment-2.Rmd` and insert your R code where wherever you see the string "INSERT YOUR ANSWER HERE"

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document.

When your are done with your answers and before submitting, save the file with the following naming convention :your **Lastname_firstname**

Submit **both** the rmd and the pdf output(or word or html) files, failing to submit **both** will be subject to mark deduction.

This assignment may make use of data provided by the `ISwR` package.

```
library(ISwR)
```

Sample Question and Solution

Use `seq()` to create the vector (1,2,3, ... ,10).

```
seq(1,10)
```

```
##  [1]  1  2  3  4  5  6  7  8  9 10
```

Question 1 (50%)

Consider the probability distribution associated with rolling 3 fair dice. We can label the faces of a single die using the numbers from 1 to 6. We can therefore label the simple events in this distribution by triples of numbers from 1 to 6. Let `d1`, `d2`, and `d3` represent the labels on each of the dice.

a) Set `d1` to the sequence (1,2,...,6) repeated 36 times.

```
d1 = rep(1:6, times = 36)
```

b) Set `d2` to the sequence consisting of 6 repetitions of the sequence in which each of the numbers (1,2,...,6) is repeated 6 times.

```
d2 = rep(1:6, each = 6, times = 6)
```

c) Set `d3` to the sequence in which each of the numbers (1,2,...,6) is repeated 36 times.

```
d3 = rep(1:6, each = 36)
```

d) Create a new data frame `three.dice` from `d1`, `d2`, and `d3` and print it. Visually confirm that there are $6 \times 6 \times 6 = 216$ rows and each row contains a unique combination of dice labels.

```
three.dice = data.frame(d1, d2, d3)
print(three.dice)
```

```
##     d1 d2 d3
## 1    1  1  1
## 2    2  1  1
## 3    3  1  1
## 4    4  1  1
## 5    5  1  1
## 6    6  1  1
## 7    1  2  1
## 8    2  2  1
## 9    3  2  1
## 10   4  2  1
## 11   5  2  1
## 12   6  2  1
## 13   1  3  1
## 14   2  3  1
## 15   3  3  1
## 16   4  3  1
## 17   5  3  1
## 18   6  3  1
## 19   1  4  1
## 20   2  4  1
## 21   3  4  1
## 22   4  4  1
## 23   5  4  1
## 24   6  4  1
## 25   1  5  1
## 26   2  5  1
## 27   3  5  1
## 28   4  5  1
## 29   5  5  1
## 30   6  5  1
## 31   1  6  1
## 32   2  6  1
## 33   3  6  1
## 34   4  6  1
## 35   5  6  1
## 36   6  6  1
## 37   1  1  2
```

```
## 38   2  1  2
## 39   3  1  2
## 40   4  1  2
## 41   5  1  2
## 42   6  1  2
## 43   1  2  2
## 44   2  2  2
## 45   3  2  2
## 46   4  2  2
## 47   5  2  2
## 48   6  2  2
## 49   1  3  2
## 50   2  3  2
## 51   3  3  2
## 52   4  3  2
## 53   5  3  2
## 54   6  3  2
## 55   1  4  2
## 56   2  4  2
## 57   3  4  2
## 58   4  4  2
## 59   5  4  2
## 60   6  4  2
## 61   1  5  2
## 62   2  5  2
## 63   3  5  2
## 64   4  5  2
## 65   5  5  2
## 66   6  5  2
## 67   1  6  2
## 68   2  6  2
## 69   3  6  2
## 70   4  6  2
## 71   5  6  2
## 72   6  6  2
## 73   1  1  3
## 74   2  1  3
## 75   3  1  3
## 76   4  1  3
## 77   5  1  3
## 78   6  1  3
## 79   1  2  3
## 80   2  2  3
## 81   3  2  3
## 82   4  2  3
## 83   5  2  3
## 84   6  2  3
## 85   1  3  3
## 86   2  3  3
## 87   3  3  3
```

```
## 88   4  3  3
## 89   5  3  3
## 90   6  3  3
## 91   1  4  3
## 92   2  4  3
## 93   3  4  3
## 94   4  4  3
## 95   5  4  3
## 96   6  4  3
## 97   1  5  3
## 98   2  5  3
## 99   3  5  3
## 100  4  5  3
## 101  5  5  3
## 102  6  5  3
## 103  1  6  3
## 104  2  6  3
## 105  3  6  3
## 106  4  6  3
## 107  5  6  3
## 108  6  6  3
## 109  1  1  4
## 110  2  1  4
## 111  3  1  4
## 112  4  1  4
## 113  5  1  4
## 114  6  1  4
## 115  1  2  4
## 116  2  2  4
## 117  3  2  4
## 118  4  2  4
## 119  5  2  4
## 120  6  2  4
## 121  1  3  4
## 122  2  3  4
## 123  3  3  4
## 124  4  3  4
## 125  5  3  4
## 126  6  3  4
## 127  1  4  4
## 128  2  4  4
## 129  3  4  4
## 130  4  4  4
## 131  5  4  4
## 132  6  4  4
## 133  1  5  4
## 134  2  5  4
## 135  3  5  4
## 136  4  5  4
## 137  5  5  4
```

```
## 138  6  5  4
## 139  1  6  4
## 140  2  6  4
## 141  3  6  4
## 142  4  6  4
## 143  5  6  4
## 144  6  6  4
## 145  1  1  5
## 146  2  1  5
## 147  3  1  5
## 148  4  1  5
## 149  5  1  5
## 150  6  1  5
## 151  1  2  5
## 152  2  2  5
## 153  3  2  5
## 154  4  2  5
## 155  5  2  5
## 156  6  2  5
## 157  1  3  5
## 158  2  3  5
## 159  3  3  5
## 160  4  3  5
## 161  5  3  5
## 162  6  3  5
## 163  1  4  5
## 164  2  4  5
## 165  3  4  5
## 166  4  4  5
## 167  5  4  5
## 168  6  4  5
## 169  1  5  5
## 170  2  5  5
## 171  3  5  5
## 172  4  5  5
## 173  5  5  5
## 174  6  5  5
## 175  1  6  5
## 176  2  6  5
## 177  3  6  5
## 178  4  6  5
## 179  5  6  5
## 180  6  6  5
## 181  1  1  6
## 182  2  1  6
## 183  3  1  6
## 184  4  1  6
## 185  5  1  6
## 186  6  1  6
## 187  1  2  6
```

```
## 188   2   2   6
## 189   3   2   6
## 190   4   2   6
## 191   5   2   6
## 192   6   2   6
## 193   1   3   6
## 194   2   3   6
## 195   3   3   6
## 196   4   3   6
## 197   5   3   6
## 198   6   3   6
## 199   1   4   6
## 200   2   4   6
## 201   3   4   6
## 202   4   4   6
## 203   5   4   6
## 204   6   4   6
## 205   1   5   6
## 206   2   5   6
## 207   3   5   6
## 208   4   5   6
## 209   5   5   6
## 210   6   5   6
## 211   1   6   6
## 212   2   6   6
## 213   3   6   6
## 214   4   6   6
## 215   5   6   6
## 216   6   6   6
```

e) Since the dice are fair and independent, each simple event has the same probability, namely $\frac{1}{216}$. Add the column `P` to the data frame with this value.

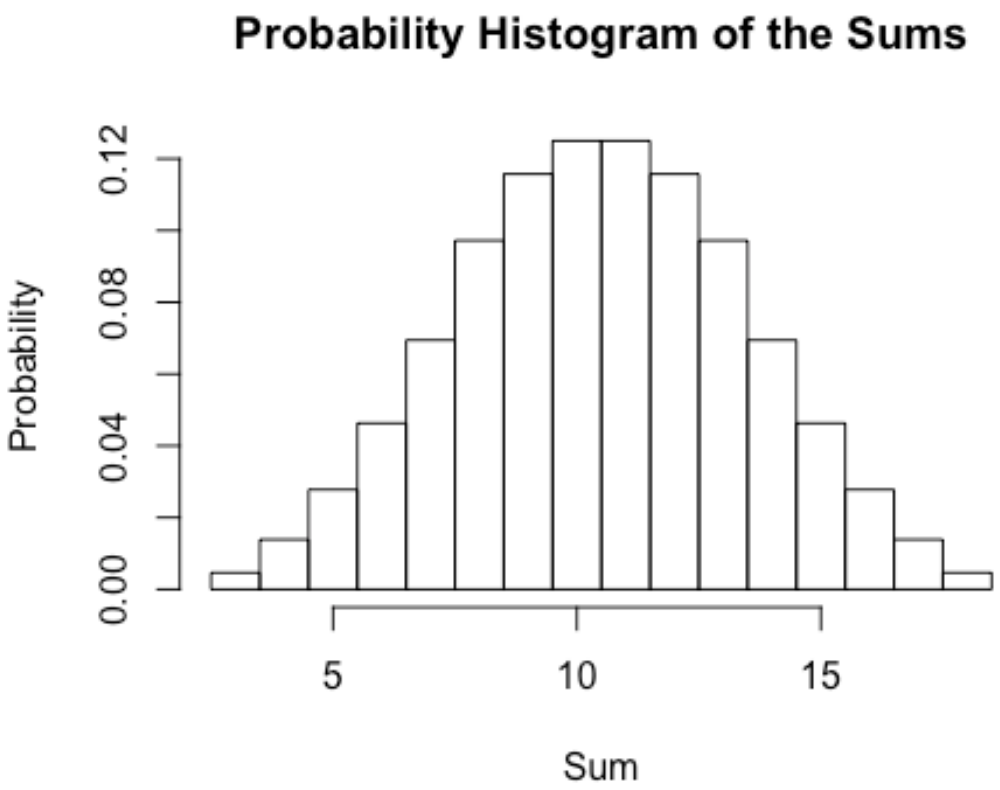
```
three.dice$P = 1/216
```

f) Add a new column `sum` equal to the sum of the dice labels. Add another new column `mean` equal to the average of the dice labels.

```
three.dice$sum = d1 + d2 + d3
three.dice$mean = (d1 + d2 + d3)/3
```

g) Plot a probability histogram of `three.dice$sum`.

```
phistogram = hist(three.dice$sum, freq = 0, breaks = 2.5:18.5, main =
"Probability Histogram of the Sums", xlab = "Sum", ylab =
"Probability")
```




```
phistogram$counts
```

```
##  [1]  1  3  6 10 15 21 25 27 27 25 21 15 10  6  3  1
```

h) Compute the probability that the sum of the dice is greater then 12 and less than 18.

HINT: Use `subset()` to select the events and sum `P`.

```
sum(subset(three.dice, sum > 12 & sum < 18, select = P))
```

```
## [1] 0.2546296
```

i) Compute the probability that the sum is even.

```
sum(subset(three.dice, sum %% 2 == 0, select = P))
```

```
## [1] 0.5
```

j) Compute the probability that the mean is exactly 4.

```
sum(subset(three.dice, mean == 4, select = P))
```

```
## [1] 0.1157407
```

Question 2 (50%)

a)You have two groups of distinctly different items, 10 in the first group and 8 in the second. If you select one item from each group, how many different pairs can you form?

```
n = 10
m = 8
n * m
```

```
## [1] 80
```

b)Evaluate the following permutation P_3^5

```
choose(5, 3) * factorial(3)
```

```
## [1] 60
```

c)Evaluate the following combinations $C_3^5 + C_2^5$

```
choose(5, 3) + choose(5, 2)
```

```
## [1] 20
```

d)In how many ways can you select five people from a group of eight if the order of selection is important?

```
choose(8, 5) * factorial(5)
```

```
## [1] 6720
```

e)In how many ways can you select two people from a group of 20 if the order of selection is not important?

```
choose(20, 2)
```

```
## [1] 190
```

END of Assignment #2.