APM1110 - FA 2 - Dacanay

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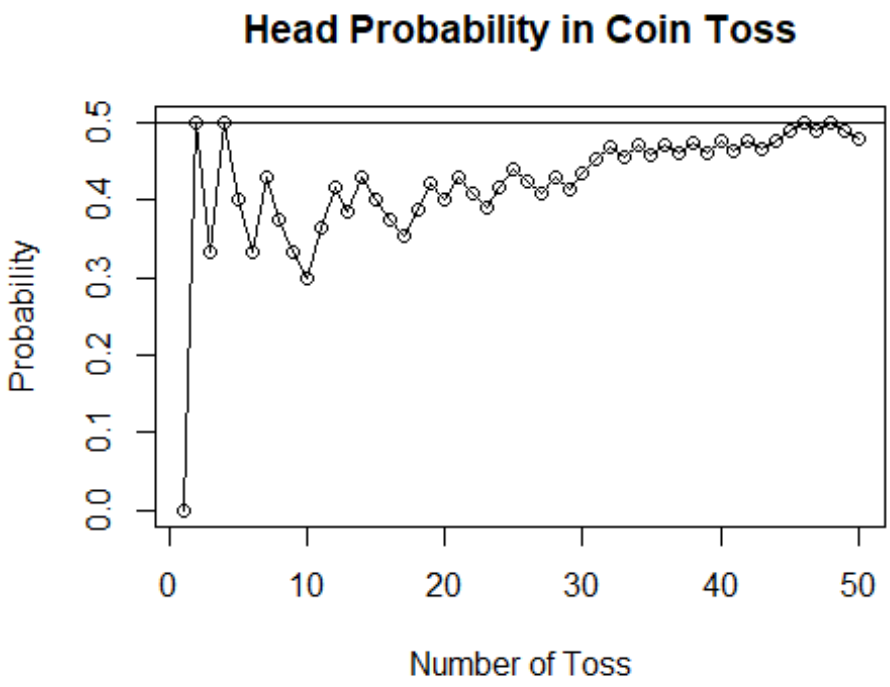
1) Use R to illustrate that the probability of getting:

###(a) a head is 0.5 if a fair coin is tossed repeatedly; #### Probability Table

```
# Simulate 100 coin tosses
print('Let Head = 1 and Tail = 0')

## [1] "Let Head = 1 and Tail = 0"

y <- sample (c(1, 0), 50, replace = TRUE)

# Probability Table
fair_coin_probability <- table(y)/50
fair_coin_probability

## y
##    0    1
## 0.52 0.48
```

Probability Plot

```
num <- 1:50
# Partial Probability
partial_events <- cumsum(y)
partial_probability <- partial_events / num

# Plot
plot(num, partial_probability, type = "o",
xlab = "Number of Toss", ylab = "Probability",
main = "Head Probability in Coin Toss")
abline(h=0.5)
```



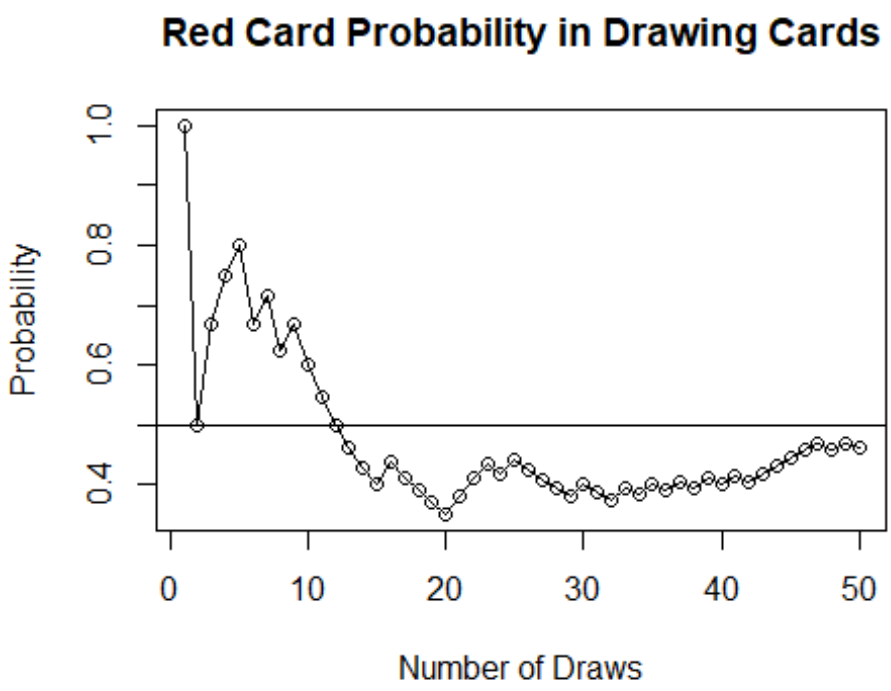
###(b) a red card is 0.5 if cards are drawn repeatedly with replacement from a well-shuffled deck; ####Probability Table

```
# Simulate 50 card draws
print('Let Red = 1 and Black = 0')

## [1] "Let Red = 1 and Black = 0"

# Define the deck
deck <- c(rep(1, 26), rep(0, 26))
draws <- sample(deck, 50, replace = TRUE)

# Probability Table
red_card_probability <- table(draws)/50
red_card_probability

## draws
##    0    1
## 0.54 0.46
```

Probability Plot

```
num <- 1:50
# Partial Probability
partial_events <- cumsum(draws)
partial_probability <- partial_events / num

# Plot
```

```r
plot(num, partial_probability, type = "o",
xlab = "Number of Draws", ylab = "Probability",
main = "Red Card Probability in Drawing Cards")
abline(h=0.5)
```



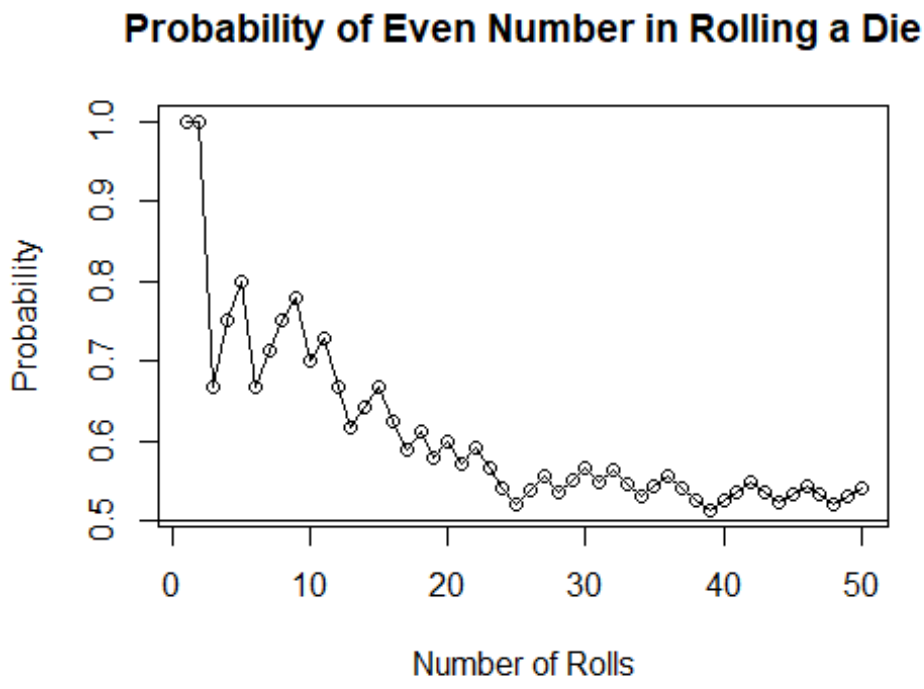
###(c) an even number is 0.5 if a fair die is rolled repeatedly. ####Probability Table

```r
# Simulate 50 die rolls
print('Let Even Numbers (2, 4, 6) = 1 and Odd Numbers (1, 3, 5) = 0')

## [1] "Let Even Numbers (2, 4, 6) = 1 and Odd Numbers (1, 3, 5) = 0"

# Define the deck
dice <- c(rep(1, 3), rep(0, 3))
rolls <- sample(dice, 50, replace = TRUE)

# Probability Table
fair_die_probability <- table(rolls)/50
fair_die_probability

## rolls
##    0    1
## 0.46 0.54
```

####Probability Plot

```r
num <- 1:50
# Partial Probability
```

```r
partial_events <- cumsum(rolls)
partial_probability <- partial_events / num

# Plot
plot(num, partial_probability, type = "o",
xlab = "Number of Rolls", ylab = "Probability",
main = "Probability of Even Number in Rolling a Die")
abline(h=0.5)
```



2) An experiment consists of tossing two fair coins. Use R to simulate this experiment 100 times and obtain the relative frequency of each possible outcome. Hence, estimate the probability of getting one head and one tail in any order.

```r
# Generate Sample Spaces
states <- c("H", "T")
S <- expand.grid(states, states)
sample_spaces <- apply(S, 1, paste, collapse = "")

# Simulate 100 coin tosses
x <- sample(sample_spaces, 100, replace = TRUE)

# Calculate relative frequencies
coin_toss_probability <- table(x) / 100
print('Coin Toss Probability Table')

## [1] "Coin Toss Probability Table"
```

```r
coin_toss_probability
```

```
## x
##   HH   HT   TH   TT
## 0.26 0.22 0.24 0.28
```

```r
# Probability of one head and one tail
probability_HT_TH <- coin_toss_probability["HT"] +
coin_toss_probability["TH"]

# Print the combined probability
print('Probability of One Head and One tail')
```

```
## [1] "Probability of One Head and One tail"
```

```r
probability_HT_TH
```

```
##   HT
## 0.46
```

```r
# Probability in percentage
print('Probability of One Head and One Tail in Percentage:')
```

```
## [1] "Probability of One Head and One Tail in Percentage:"
```

```r
print(sprintf("%.2f%%", probability_HT_TH * 100))
```

```
## [1] "46.00%"
```