

# IE-231 In-Class Activity Solutions

Due Date Feb 24, 2017, 16:00

Feb 25, 2017

This is a graded in-class assignment. Show all your work in R Markdown files. Submit compiled HTML files only.

## Question 1

Suppose drawing two cards from a deck and tossing two coins. Answer the following questions.

- a) What is the experiment?

The experiment is “drawing two cards from a deck and tossing two coins”.

- b) What is “getting two heads and two aces or one head one tail one queen one king”? Pick one (Event / Outcome / Sample Space)

Event.

- c) Give an example of two mutually exclusive events.

Event A: Jack of Spades / Queen of Hearts / Heads / Heads  
Event B: Ace of Clubs / Ace of Diamonds / Tails / Tails

- d) What is the probability of getting one head and one tail (in any order) and getting two Jacks?

```
#It can be either HT or TH so probability of the coins is 1/2  
#Getting the first Jack has probability of 4/52  
#Getting the second Jack has probability of 3/51  
1/2*4/52*3/51
```

```
## [1] 0.002262443
```

- e) How many different outcomes can there be? Assume ordering is important (e.g. HT and TH are different outcomes).

```
#Two outcomes per coin  
#52 outcomes for the first card draw  
#51 outcomes for the second card draw  
#Multiplication rule  
2*2*52*51
```

```
## [1] 10608
```

## Question 2

In how many ways can you arrange the letters of “COMPUTERLAB”?

- a) Any order.

```
#Permutation rule  
#11 characters no repetitive letters  
factorial(11)
```

```
## [1] 39916800
```

b) Vowels together?

```
#4 vowels, 7 consonants  
#Assume all vowels are a single "letter". So 8 characters.  
#But vowels permute within the single "letter".  
#Multiplication rule  
factorial(7+1)*factorial(4)
```

```
## [1] 967680
```

c) Vowels in alphabetical order?

```
#We start with all the permutations 11!  
#For any permutation there can be only one ordering of vowels.  
#For instance COMPUTERLAB is not valid but CAMPETORLUB is valid  
#So remove invalid permutations with division  
factorial(11)/factorial(4)
```

```
## [1] 1663200
```

d) There should be no consecutive vowels?

```
#There are 7 consonants, 4 vowels.  
# Assume Xs are consonants and .s are potent vowel places.  
# .X.X.X.X.X.X.X.  
#Consonants can permute in any order so 7! there  
#8 places for vowels but only 4 vowels.  
# So it is a permutation of 4 out of 8 places.  
factorial(7)*(factorial(8)/factorial(8-4))
```

```
## [1] 8467200
```

### Question 3

In how many ways can you arrange the letters of "HETEROSKEDASTICITY"?

```
# 18 characters.  
# 7 vowels, 11 consonants  
# 3 Es, 3 Ts, 2 Is, 2 Ss
```

a) Any order.

```
#By the formula of permutation with repetitive letters  
#Assign the value to all_perms object  
all_perms<-factorial(18)/(factorial(3)*factorial(3)*factorial(2)*factorial(2))  
all_perms
```

```
## [1] 4.446093e+13
```

b) Vowels together?

```
#Assume all vowels are single "character" again. So 12 characters  
(factorial(11+1)/(factorial(3)*factorial(2)))*(factorial(7)/(factorial(3)*factorial(2)))
```

```
## [1] 16765056000
```

c) Vowels in alphabetical order?

```
#Same as the last question. But be careful about identical vowels.  
all_perms/(factorial(7)/(factorial(3)*factorial(2)))
```

```
## [1] 105859353600
```

d) There should be no consecutive vowels?

```
#Same as the last question. But be careful about identical vowels.
```

```
(factorial(11)/factorial(3)*factorial(2))*(factorial(12)/factorial(12-7))/(factorial(3)*factorial(2))
```

```
## [1] 4.425975e+12
```

## Question 4

Suppose you are putting the top 16 football teams in 4 groups evenly (each group should consist of 4 teams). In how many different ways can you arrange the teams?

```
#It is either a chain of combinations or just grouping combination  
choose(16,4)*choose(12,4)*choose(8,4)
```

```
## [1] 63063000
```

## Question 5

There are 20 people; 10 from Ankara, 10 from Istanbul.

a) Suppose you want to form a group of 5 people with at least 1 person from Ankara and Istanbul. In how many ways can you form such a group?

```
#Calculate as if no rules. It is the combination of 20 to 5.  
#Then remove the combinations of all Ankara or all Istanbul people  
choose(20,5) - choose(10,5) - choose(10,5)
```

```
## [1] 15000
```

b) In how many ways can you form a group of 3 people from Istanbul and 4 people from Ankara?

```
#Simply separate combinations with multiplication rule.  
choose(10,3)*choose(10,4)
```

```
## [1] 25200
```