Badji Mokhtar University – Annaba

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Faculty of Technology

2nd Year, Science and Technology Program

Exercises Sheet n°03: Combinatorial Analysis And Probability

Exercise 1: With the numbers $\{2, 3, 5, 6, 7, 9\}$, how many 3-digit numbers can we have?

1. With and without repetition.
2. How many of these are less than 400? (With and without repetition).
3. How many of these are even? (With and without repetition).
4. How many of these are odd? (With and without repetition).
5. How many of these are multiples of 5? (With and without repetition).

Exercise 2: How many ways can 4 boys and 2 girls sit in a row if:

1. The boys sit together and girls sit together.
2. Each girl will be seated between two boys.
3. The 2 girls must sit next to each other.

Exercise 3: In a company we have 3 engineers and 5 technicians; we want to form teams of 3 people. Calculate the number of possibilities of having:

1. An engineer.
2. At least one engineer.
3. At most 3 technicians.

Exercise 4: An urn contains 8 white balls and 4 black balls. The balls are drawn at random one after the other and without replacement.

1. What are the numbers of possibilities such that the first ball is white?
2. What are the numbers of possibilities such that the first ball is black?
3. What is the number of possibilities to obtain a white ball for the first time in draw number 4 or 5?

Exercise 5: A box contains 10 white balls, 6 red and 4 black.

a) 3 balls are drawn simultaneously. Calculate the number of possibilities to obtain:

   1. 3 balls of the same color.

2. Only 2 balls of the same color.
3. Different colors.

b) We now draw 3 balls successively and without replacement. Calculate the number of possibilities to obtain:

1. 3 white balls.
2. A red, black and white ball in that order.

Exercise 6: In a class, 15% of the mathematics grades are insufficient, 25% of the physics grades are insufficient, and 10% of the students have insufficient grades in both subjects.

a) A student has an insufficient grade in physics. Compute the probability that he also has an insufficient grade in mathematics.

b) A student has an insufficient grade in mathematics. Compute the probability that he also has an insufficient grade in physics.

Exercise 7: We toss a coin three times. We consider the following events:

a) A: the first toss gives heads.

b) B: the second toss gives heads.

c) C: (exactly) two consecutive tosses give heads.

Are these events pairwise independent? Are these events pairwise mutually exclusive?

Exercise 8: A filter for unwanted electronic messages (spam) is programmed as follows: the message is scanned, and if it contains the word "free," then the message is set aside. It is known that 80% of circulating electronic messages are spam and that 10% of these contain the word "free." The word "free" appears in 1% of the messages that are not spam.

a) What is the probability that a message contains the word "free"?

b) A message has just arrived. If it contains the word "free," what is the probability that it is spam?

Exercise 9: A six-sided die is rolled. We denote by P_i the probability of obtaining the face marked i. This die is biased in such a way that the probabilities of the faces are:

$$P_1 = 0.1, \quad P_2 = 0.2, \quad P_3 = 0.3, \quad P_4 = 0.1, \quad P_5 = 0.15$$

a) What is the probability of obtaining the face marked 6?

b) What is the probability of obtaining an even number?