

# Calculus en Kansrekening

## Assignment 6, October 9, 2014

**Handing in your answers:** To read the full story, see

[http://www.ru.nl/ds/education/courses/analyse\\_2014/](http://www.ru.nl/ds/education/courses/analyse_2014/)

Briefly,

- make sure to put
  - your name;
  - your student number and
  - the name of your TA (Safet and Arjen OR Ana Helena OR Gergely)on your solution sheet;
- submit via Blackboard (<http://blackboard.ru.nl>);
- it is one single pdf file.

**Deadline: Friday, October 17, 13:30 sharp!**

**Goals:** After completing these exercises successfully you should be confident with the following topics.

- Computing basic combinatorial problems;
- The Birthday paradox.

**Marks:** You can score a total of 100 points. Note that you have to **explain your answers**, so it is clear how you have got the result. In order to get full points, you need to make sure that the reader can understand each step in your solution.

1. **(10 points)** Vanessa wants to give her friend potted plants as present. At the local florist, the flowers come in four colours, and there are three types of flower pots.
  - (a) If Vanessa buys one potted flower (any combination of a flower and a pot), how many different options can Vanessa choose from?
  - (b) If Vanessa buys two potted flowers and she wants two different combinations, how many options does she have? (Two combinations are different if at least the colours of the flowers or the types of the pots are different.)
2. **(5 points)** In how many ways can seven people be seated on a sofa if there are only four seats available.
3. **(10 points)** Three cards are drawn at random (without replacement) from an ordinary deck of 52 cards.<sup>1</sup> Find the number of ways in which one can draw
  - (a) a diamond and a club and a heart in succession;
  - (b) two hearts and then a club or a spade.
4. **(20 points)** How many numbers, consisting of five different digits each, can be made from the digits 1, 2, 3, ..., 9 if
  - (a) the numbers must be odd?
  - (b) the first two digits of each number are even?
  - (c) How many numbers are in (a) and (b) if repetitions of the digits are allowed?
5. **(5 points)** How many different committees of 3 men and 4 women can be formed from 9 men and 6 women.

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<sup>1</sup>The four suits are as follows: spades ♠, hearts ♥, diamonds ♦ and clubs ♣.

6. **(5 points)** There are 8 people in a room. If everyone shakes everyone else's hand exactly once, how many handshakes occur?
7. **(10 points)** From seven consonants and five vowels, how many words can be formed consisting of four different consonants and three different vowels? The words need not have meaning.
8. **(15 points)** Expand the following expressions, either directly or via binomial coefficients. Make it clear how you proceed.
- (a)  $(x + 6)^3$ ;
  - (b)  $(x - y)^4$ ;
  - (c)  $(x^2 + 2)^4$ ;
9. **(5 points)** Find the coefficient that is written before  $x$  in the expansion of  $(x + \frac{2}{x})^9$ .
10. **(5 points)** A school has 5 maths teachers, 3 English teachers and 2 IT teachers. From this whole group, a 5 teacher committee has to be established. Calculate the number of ways that this committee can be formed if at least one IT teacher must be on the committee.
11. **(10 points)** There are 12 provinces in the Netherlands. What is the probability that at least 2 of  $r$  randomly selected Dutch-born people were born in the same province, where  $r = 1, r = 2, r = 3, r = 4, r = 5$  or  $r = 6$ ?