Formal Aspects of Computer Science (2010/2011)
Practical Algorithms and Discrete Mathematics #1 (week 3)

1. [Rosen, p.344, Ex.1] There are 18 mathematics majors and 325 computer science majors at a college.

   (a) How many ways are there to pick two representatives so that one is a mathematics major and the other is a computer science major?

   (b) How many ways are there to pick one representative who is either a mathematics major or a computer science major?

2. [Rosen, p.344, Ex.6] There are four major autoroutes from Boston to Detroit and six from Detroit to Los Angeles. How many major autoroutes are there from Boston to Los Angeles via Detroit.

3. [Lecture notes, week 1] A bookshelf contains 4 English books, 5 German books, and 3 Russian books. The books all have different titles (no copies of the same book).

   (a) In how many different ways can we choose one book?

   (b) In how many different ways can we choose one book from each language? [Here the order in which the three books are chosen is not important; so we only count different outcomes according to the titles of the chosen books, not according to the order in which they were chosen].

4. [Rosen, p.344, Ex.3] A multiple-choice test contains 10 questions. There are four possible answers for each question.

   (a) How many ways can a student answer the questions on the test if the student answers every question?

(b) How many ways can a student answer the questions on the test if the student can leave answers blank?

5. A bit is a symbol with two possible values, namely 0 and 1. A bit string is a sequence of bits.

   (a) Write down all the bit strings of length four.

   (b) How many bit strings are there of length four?

   (c) How many bit strings of length four start and end with 1s?

6. [Lecture notes, week 1]

   (a) How many bit strings are there of length six?

   (b) How many bit strings of length six start and end with 1s?

7. [Rosen, p.344, Ex.13] How many bit strings with length not exceeding n, where n is a positive integer, consist entirely of 1s?

8. [Rosen, p.344, Ex.7-9]

   (a) How many different three-letter initials can people have?

   (b) How many different three-letter initials with none of the letters repeated can people have?

   (c) How many different three-letter initials are there that begin with an A?

   (d) How many different three-letter initials are there if adjacent letters can not be alike?

9. [Lecture notes, week 1] Five people give presentations. How many different ways are there to timetable them?

10. [Rosen, p.344, Ex.17] How many strings of five ASCII characters contain the character @ ("at" sign) at least once? [There are 128 different ASCII characters.]

11. [Rosen, p.344, Ex.18] How many positive integers between 5 and 31

    (a) are divisible by 3? Which integers are these?

    (b) are divisible by 4? Which integers are these?

    (c) are divisible by 3 and by 4? Which integers are these?

12. [Rosen, p.344, Ex.39] A *palindrome* is a string whose reversal is identical to the string.

    (a) How many bit strings of length 12 are palindromes?

    (b) How many bit strings of length 13 are palindromes?