

Write first clearly on each sheet of paper

- Mat–1.128 EDM, exam. 13.5.2003
- Student identification number, family name, given names, faculty, signature

1. The letters of the word *ANACONDA* are cut separate from each other, and they are used to build up ‘words’ in a random way, under the condition that at most one occurrence of each letter may remain absent. How many different words is it possible to construct under these circumstances? Make use of a generating function of an appropriate type.

2. Let it be $A = \{a, b, c, d, e\}$ and $B = \{0, 1, 2, 3, 4, 5, 6\}$. Use *rook polynomial* to find how many such *injective* functions (which, by definition, satisfy $x \neq y \Rightarrow f(x) \neq f(y)$) are there that fulfill the conditions

$$f(a) \neq 5, 6, \quad f(b) \neq 2, 4, \quad f(c) \neq 1, 2, 3, \quad f(d) \neq 0, 1, 6, \quad f(e) \neq 1, 3, 4.$$

3. a) Find the inverse $52^{-1} \pmod{650}$, if it exists.
b) Solve the congruence problem $52x \equiv 338 \pmod{650}$.

4. A Hamming $(7, 4)$ – code has the parity check matrix

$$H = \begin{pmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{pmatrix}$$

- a) Encode the message words 1101 and 1010.
b) Decode the received words 1111000 and 0110011.
c) A symmetric binary channel is used for data transmission. The error probability in transmission of a single bit is $p = 0.8\%$. What is the probability for an erroneous decoding of the two–word message in part a)?