University of Technology   .Ilkka

Mat – 1.128   **Elements of Discrete Mathematics** (3 cp)
Examination   10.1.2003

Write first clearly on each sheet of paper

– Mat–1.128   EDM,   exam.   10.1.2003
– Student identification number, family name, given names, faculty, signature

1.   The integers $1, 2, \ldots, 8$ lie on a circle in an arbitrary circular order. Prove that there are three adjacent numbers whose sum is at least 14 .

2.   How many different regular octahedrons is it possible to make using red, yellow, and/or green straws, if the piece may be turned in any position in space? And how many, if there are equal numbers of straws of each colour? Use Polya's Theorem or related results.

3. $a)$ Find all solutions for the Diophantine equation

$$57821\, x + 47465\, y = 11219 ,$$

and, specially, the solution with smallest possible $|x|$.

$b)$ We know that $n = pq = 162\,131$ is a product of two prime integers, and that $\varphi(n) = 161\,112$.   Find the primes p and q .

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

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

$a)$ Encode the information words 1110 and 0011 .

$b)$ Decode the received words 1010101 and 1100010 .

$c)$ A symmetric binary channel with a probability $p = 0.5\,\%$ for an erroneous bit was used for the transfer of data. What is the probability for the correct interpretation of the message of two words sent in $a)$?