

## 12.010 Homework #1

Due Thursday September 22, 2005

**Question (1): (10-points)** Express the following numbers in base 2, 8, 10, and 16 as appropriate (subscript denotes the base of the input number).

$255_{10}$

$57007_{10}$

$A0_{16}$

$1505_8$

**Question (2): (10-points)** How long will it take on a 56K modem to transfer a 56 Mbytes file? How long on 100 Mbps T1 Ethernet line?

**Question (3): (10-points)** In a computer with 356 Mbytes of memory, what is the maximum size matrix that can be stored with 8-bytes per number in (a) full storage i.e.,  $N \times N$ , (b) lower triangular form. What are the values if the numbers are stored in 4-byte number (assume all of the memory can be used for storage). The numbers here should be exact, not approximations.

**Question (4): (20-points)** In class we gave the precision and range for IEEE 4-byte floating point numbers. What is the precision and range for IEEE 8-byte floating-point numbers? (For 8-byte floating point IEEE uses 11 bits for the exponent and 53 bits for the mantissa (don't forget about the sign bits).

**Question (5): (50-points)** Design an algorithm to predict the path of an aircraft gliding with out power. This problem will lead to later questions where you will write a program to predict where a glider will land given and initial height and speed. The later questions will also ask how to control the aircraft to land at a specified location. In this question you are not writing computer code: You are finding the equations you will need to use and thinking about how to implement those equations into an algorithm to solve this problem. You will write (in English) a description of

(1) Equations of motions of the glider: Ask and find out equations for the forces acting on the glider.

(2) Converting forces and accelerations: Given the forces acting on the glider, how do you calculate the motion of the glider.

(3) Controlling the glider: How will a program control where the glider lands

(4) Input and outputs for the program. What types of information will the programs will need input and output?

Your answer should address each of the items above. Your answer should be equations and written description.

Answers should be emailed as PDF, Word or text files.