İTÜ Computer Engineering Department **04/04/2007**
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BIL105E - INTRODUCTION TO SCIENTIFIC AND ENGINEERING COMPUTING

MIDTERM EXAM

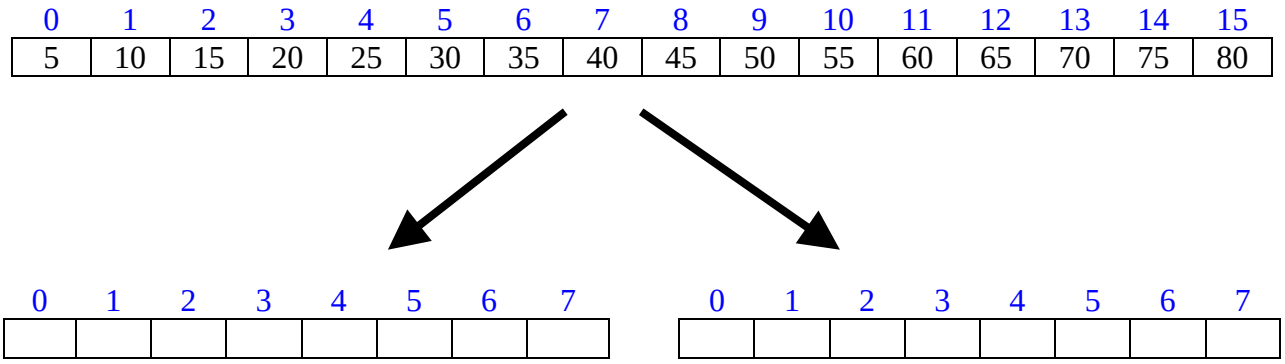
(There are 4 Questions. 2-Hour Exam)

Q.1) (30) Monte Carlo methods can be thought of as statistical simulation methods that utilize a sequence of random numbers to perform the simulation. The name "Monte Carlo'' was coined by Nicholas Constantine Metropolis (1915-1999) and inspired by Stanslaw Ulam (1909-1986), because of the similarity of statistical simulation to games of chance, and because Monte Carlo is a center for gambling and games of chance. In this question you will write a simple Monte Carlo simulation to approximate the value of π. It involves randomly selecting points $\{(x_i, y_i)\}_{i=1}^{n}$ in the unit square and determining the ratio $\rho = \frac{m}{n}$, where *m* is number of points that satisfy $x_i^2 + y_i^2 \leq 1$. You will read *n* from the keyboard, perform the simulation as explained above and print the ratio ρ to the screen.

Q.2) (20) Write a function (**getSumOfOddDigits**) which takes an **unsigned long integer** and returns the sum of **only** its **odd** valued **digits**. Example: for n=2**3**4**5**6**7**9**8**, the function should return 3+5+7+9=**24**.

Q.3) (30) Draw a flowchart and write a complete program which performs the following tasks:

- Initialize the original array as shown above.
- **Split** the original array **randomly** into **two other arrays** (the two new arrays should have almost equal lengths.) Then, display the contents of two new arrays.



Q.4) (20) Draw a flowchart and write a complete program which performs the following tasks:

- Read values from keyboard for the coefficients *A*, *B*, *C*, *D*, *E*, *F* of the equations of two straight lines.

$$Ax + By = C$$
$$Dx + Ey = F$$

- Then determine whether the lines are parallel (their slopes are equal) or the lines intersect.
- If they intersect, determine whether the lines are perpendicular (the multiplication of their slopes is equal to -1).