Benha University
Faculty of Engineering (at Shoubra)
Electrical Engineering Department
M.Sc. (Computer Systems Engineering**)**

Midterm Exam
Subject: Advanced Algorithms - CES 608
Date: Sat 02/04/2016
Duration: 30 minutes

Attempt the following questions.

№ of Questions: 3 in 2 page(s)
Total Mark: 30

Question 1: **(10** Marks**)**

Consider the problem of adding two n-bit binary integers, stored in two n-element arrays A and B. The sum of the two integers should be stored in binary form in an $(n+1)$-element array C.
State the problem formally and write pseudocode for adding the two integers.

Question 2: **(10** Marks**)**

Use a recursion tree to give an asymptotically tight solution to the recurrence $T(n) = T(\alpha n) + T((1-\alpha)n) + cn$, where α is a constant in the range $0 < \alpha < 1$ and $c > 0$ is also a constant. Verify your solution by the substitution method.

Question 3: **(10** Marks**)**

Suppose that instead of swapping element $A[i]$ with a random element from the subarray $A[i..n]$, we swapped it with a random element from anywhere in the array:

```
PERMUTE-WITH-ALL(A)
1 n = A.length
2 for i = 1 to n
3     swap A[i] with A[RANDOM(1,n)]
```

Does this code produce a uniform random permutation? Why or why not?

Good Luck
Dr. Islam ElShaarawy