

# Computer Science Foundation Exam

May 6, 2016

Section I A

## COMPUTER SCIENCE

**NO books, notes, or calculators may be used,  
and you must work entirely on your own.**

**Name:** \_\_\_\_\_

**UCFID:** \_\_\_\_\_

Question #	Max Pts	Category	Passing	Score
1	10	DSN	7	
2	10	ANL	7	
3	10	ALG	7	
4	10	ALG	7	
5	10	ALG	7	
<b>TOTAL</b>	<b>50</b>		<b>35</b>	

**You must do all 5 problems in this section of the exam.**

**Problems will be graded based on the completeness of the solution steps and not graded based on the answer alone. Credit cannot be given unless all work is shown and is readable. Be complete, yet concise, and above all be neat.**

**1)** (10 pts) DSN (Recursive Functions)

Complete the function below, to create a recursive function *productDigits* that takes in 1 parameter, a non-negative integer, *n*, and returns the product of *n*'s digits. For example *productDigits(232)* will return 12 ( $2 \times 3 \times 2$ ), and *productDigits(13999019)* will return 0.

```
int productDigits(int number){
```

```
}
```

**2) (10 pts) ANL (Summations)**

a) (5 pts) Determine the value of the following summation, in terms of  $n$ :  $\sum_{i=1}^{2n} (4i + 7)$ . Express your final answer as a polynomial in the form  $an^2 + bn$ , where  $a$  and  $b$  are integers.

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b) (5 pts) Determine the value of the summation below:

$$\sum_{i=21}^{100} (3i + 1)$$

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### 3) (10 pts) ALG (Stacks)

A stack of *positive integers* is implemented using the struct shown below. Using this implementation of the stack write the *push* and *peek* functions. *Assume that when a struct stack is empty, its top variable is equal to -1.*

```
#define MAX 12

struct stack{
    int top; /* indicates index of top */
    int nodes[MAX] ;
};

// Attempts to push value onto the stack pointed to by s.
// If the stack is full 0 is returned and no action is taken.
// Otherwise, value is pushed onto the stack and 1 is returned.
int push(struct stack* s, int value){

}

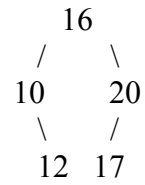
// Returns the value at the top of the stack. If the stack is
// empty, -1 is returned.
int peek(struct stack* s){

}

}
```

4) (10 pts) ALG (Data Structures Tracing - AVL Trees, Binary Heaps)

a) (5 pts) Show the result of inserting 19 into the AVL tree below. Draw a box around your final resulting tree.



b) (5 pts) In a binary heap of 100 elements, how many elements are at a depth of 6 (lowest level) from the root of the heap? (Note: the depth of an element is the number of links that have to be traversed from the root of the tree to reach it.)

**5) (10 pts) ALG (Base Conversion)**

a) (5 pts) Convert the hexadecimal number AF2E9 to binary without first converting to the base 10 equivalent.

b) (5 pts) Frank is the team-lead for the software testing team at his job. He is celebrating his birthday. Some of his co-workers have baked a cake for the celebration and thought that it would be really cool to put candles on his cake to represent his age in binary. An unlit candle represents the 0 bit. From the pic of the cake below, how old is Max?

