

MATH/CSE 1019: DISCRETE MATH FOR COMPUTER SCIENCE, FALL 2011  
Assignment 1 (Released November 14, 2011)  
Submission deadline: 5 pm, November 25 2011

Notes:

1. The assignment can be handwritten or typed. It MUST be legible.
2. You must do this assignment individually.
3. Submit this assignment only if you have read and understood the policy on academic honesty on the course web page. If you have questions or concerns, please contact the instructor.
4. Use the dropbox near the CSE main office to submit your assignments, OR submit your assignment online using the submit command from a CSE machine (follow instructions on the class webpage). No late submissions will be accepted. Please do not send files by email.

### Question 1

The power set  $\mathcal{P}(A)$  of a set  $A$  is the set of all subsets of  $A$ .

1. Prove that  $\mathcal{P}(A) \cap \mathcal{P}(B) = \mathcal{P}(A \cap B)$
2. Prove that  $\mathcal{P}(A) \cup \mathcal{P}(B) \subseteq \mathcal{P}(A \cup B)$
3. Give an example to show that  $\mathcal{P}(A) \cup \mathcal{P}(B) = \mathcal{P}(A \cup B)$  need not be true.

### Question 2

Use mathematical induction to show that  $25^{n+1} - 24n + 5735$  is divisible by  $(24)^2$  for all  $n = 1, 2, \dots$

### Question 3

Prove or disprove the following statements:

1.  $f(n) = O(g(n))$  implies  $2^{f(n)} = O(2^{g(n)})$ ,
2.  $f(n) + g(n) = \Theta(\max(f(n), g(n)))$ .

### Question 4

What is the value returned by the following function? Express your answer as a function of  $n$  only. What is the worst-case running time in big-O notation?

```
MYSTERY( $n$ )  
1  $r \leftarrow 0$   
2 for  $i \leftarrow 1$  to  $n$   
3 do for  $j \leftarrow 1$  to  $i$   
4     do for  $k \leftarrow j$  to  $i + j$   
5         do  $r \leftarrow r + 1$   
6 return( $r$ )
```