

Homework 0 - background material

Date Due: Thursday, September 9, turn in on paper in class (or via email if you are not in Boston)

Reading: Look over Chapters 1-5 in our textbook. Read whatever seems new or unfamiliar to you. Pay particular attention to big-O notation, and to chapters 2 and 3.

This homework is just a check to make sure people have some necessary math background. You need to get each question “mostly right” before you do HW 1. You can do them multiple times if needed. This quiz will be looked at but not be graded and is not part of the final grade.

1. Read over the precise definition of  $O(n^2)$ .

Give an example of a function  $g(n)$  which is not in  $O(n^2)$ .

Explain why your  $g$  function is not in  $O(n^2)$ . You should use the big-O definition to explain your answer here.

2. Define  $h(t)$  for any integer  $t \geq 1$  by  $h(1) = 2$  and  $h(t) = t + h(t-1)$  if  $t$  is any integer greater than 1.

(i). What is  $h(5)$  ?

(ii). What is  $h(t)$  ? That is find a closed form which expresses  $h(t)$  in terms of  $t$  but not  $h$ .

3. Write is the inverse of the 2 by 2 matrix  $A$  where  
 $A =$

$$\begin{matrix} 5 & 1 \end{matrix}$$

$$\begin{matrix} 5 & 2 \end{matrix}$$

4. Let B be the 3 by 3 matrix

$$\begin{matrix} 2 & 0 & 4 \\ 3 & 1 & 1 \\ -1 & 0 & 2 \end{matrix}$$

- i. What is the determinant of B ?
- ii. What is the permanent of B? If you are not familiar with the determinant of a matrix, feel free to look it up.
- iii. Let C be the matrix

$$\begin{matrix} 1/4 & 0 & -1/2 \\ -7/8 & 1 & 1/4 \\ 1/8 & 0 & 1/2 \end{matrix}$$

Is C the inverse of matrix B above ? Explain why or why not.

- iv. Draw a directed, weighted graph G which has matrix B as its adjacency matrix. (In this case we allow G to have edges from a vertex to itself.)

5. Let  $g(x) = -2x^4 - 3x^2 + 5$ .

- i. What is  $g(x) + g(x)$  ?
- ii. What is  $g(x) * g(x)$  ?
- iii. Let  $f(x) = 4x^3 - 10$ . What function  $h(y)$  is the inverse of f? that is say what function  $f^{-1}(x)$  is.