

Algorithms & Data Structures I

CSC 225

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Midterm review

- Midterm is on Wednesday October 24, in class
- **You can bring 2 pieces of papers (front and back)** of anything that you want to write down like formulas, or other things that you might forget.
- Calculator is not allowed and actually not needed.
- Don't bring scrap papers; they'll be provided.
- It's worth 10%

Midterm review

- It covers the following: (from highest priority to the lowest)
 1. All lectures until the end of **L14_linearSorting**.
 2. All lab materials (including the lab on the week of Oct 15)
 3. The 2 written assignments
 4. The 4 programming assignments
 5. All reading assignments from CLRS (Connex syllabus).

Midterm review

- There are mostly multiple choice questions (around 20-30)
- And 2-4 written problems
- The only questions that I ask from your textbook are those that we have discussed something similar to somewhere else as well, like lectures, labs or assignments
- Look at your textbook as a resource for understanding the material in the lectures better.
- However, the part about math backgrounds such as summations and log properties is a **must-know**.

Time complexity and asymptotic notations

- The definitions of asymptotic notations and proofs about asymptotic notations.
- There will be several questions like this:
- What is the time complexity of this for loop in terms of n ?

$x = 1$

for $i = 0$ **to** $n/5$

$x = x + 1$

1. $\Theta(1)$ 2. $\Theta(n)$ 3. $\Theta(n^2)$ 4. $\Theta(n \log n)$

Time complexity and asymptotic notations

Algorithm Loop4(n):

```
 $s \leftarrow 0$   
for  $i \leftarrow 1$  to  $2n$  do  
    for  $j \leftarrow 1$  to  $i$  do  
         $s \leftarrow s + i$ 
```

Algorithm Loop5(n):

```
 $s \leftarrow 0$   
for  $i \leftarrow 1$  to  $n^2$  do  
    for  $j \leftarrow 1$  to  $i$  do  
         $s \leftarrow s + i$ 
```

Algorithm Loop1(n):

```
 $s \leftarrow 0$   
for  $i \leftarrow 1$  to  $n$  do  
     $s \leftarrow s + i$ 
```

Algorithm Loop2(n):

```
 $p \leftarrow 1$   
for  $i \leftarrow 1$  to  $2n$  do  
     $p \leftarrow p \cdot i$ 
```

Algorithm Loop3(n):

```
 $p \leftarrow 1$   
for  $i \leftarrow 1$  to  $n^2$  do  
     $p \leftarrow p \cdot i$ 
```

Time complexity and asymptotic notations

- Given two functions like $f(n) = n^2$ and $g(n) = 5n^2 + 10n$ prove that $f(n) = O(g(n))$
- Also, knowing about little-oh and little-omega is necessary.

Solving recurrences

- Know the 3 methods for solving recurrences.
- There is a PDF file on Lab 3 on Connex with more than 20 solved examples on Master theorem.

Sorting and other algorithms

- Learn every single algorithm in detail along with how you can analyze it.
- For sorting algorithms learn the properties of all sorting algorithms and know when one is preferred over another.
- Know the difference between different kinds of analyses: worst-case, best-case, average-case, etc.

Linear sorting

- I taught the 3 linear sorting algorithms different from what's in your textbook.
- So, there is no reading assignment for linear sorting. However, you can still read your textbook if you want.
- Just make sure that you understand the 3 algorithms and their differences and take a look at the Java codes provided for them on Connex.

Trees

- Learn all definitions and special types of trees.
- For example, given an example tree, and some specified node; you should what are the descendants of that node or what is the level number of that node.

Probability and expectation

- Just very simple questions to the extent of what you learned in the lectures.

Sample midterm

- There is a solved sample midterm available on Connex->resources->sample midterm from Dr. little's course