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Richard Chang <chang@umbc.edu>

# CMSC 341 Snow Day Chat

March 14, 2017

**Alex Flaherty** joined the conversation

**Joshua Mpere** joined the conversation

**Paul Rehr** joined the conversation

**Robert Duguay** joined the conversation

**Parth Patel** joined the conversation

**Eduardo Adum** joined the conversation

**I-Shiun Kuo** joined the conversation

**Michael Sanchez** joined the conversation

**Yvonne Kamdem Manewa** joined the conversation

**James Chung** joined the conversation

**Eduardo Adum** - 10:52 AM
Morning Yall, happy (just enough) snow day

**Joshua Mpere** - 10:53 AM
it may snow more today I think

**Eduardo Adum** - 10:54 AM
its suppose to but i believe we are passed the heavest part

**Paul Rehr** - 10:54 AM
Anyone know what its like on campus?

**Joshua Mpere** - 10:55 AM
white

**Eduardo Adum** - 10:55 AM
lol

**Robert Duguay** - 10:55 AM
Icy

**Philip Magaletta** joined the conversation

**Adam Snyder** joined the conversation

**Ziheng Zhou** - 10:56 AM

**Eduardo Adum** - 10:56 AM
im gonna have to dig my driveway and car out  soon before it gets any worse

**Adam Snyder** - 10:56 AM
Hello?

**Eric Thompson** - 10:56 AM
hey adam

**Adam Snyder** - 10:56 AM
What's up bud?

**Ziheng Zhou** - 10:56 AM
Hola

**Eric Thompson** - 10:57 AM
Just chillin'.....get it

**Adam Snyder** - 10:57 AM
Hey Eric, what'd you get on that 331 test?

**Eduardo Adum** - 10:57 AM
booooo

**Adam Snyder** - 10:57 AM
^

Absolutely toxic

**Eric Thompson** - 10:58 AM
not disclosing infront of 50 ish witneses on a recordable medium but thanks for asking

**Joshua Mpere** - 10:58 AM
yo this is a 341 hangout not 331

**Seung Lee** joined the conversation

**Seung Lee** joined the conversation

**Adam Snyder** - 10:58 AM
You're right, but the weather doesn't really count for 341 either, so...
meh

**Eric Thompson** - 10:58 AM
but he and i share that class and its not quite 11 am relax

**Levan Sulimanov** - 10:59 AM
yes it does, because of the weather we are all up here)

**Adam Snyder** - 10:59 AM
You are technically correct sir.  I concede the point

**Damon Streat** joined the conversation

**Richard Chang** - 10:59 AM
If you are getting ready, make sure you have old exam solutions and hw3 solutions pulled up.

**Eduardo Adum** - 11:00 AM
roger roger

**Brian D. Hanson, Jr.** - 11:00 AM
There are no hw3 solutions in my shared folder

**Yael Weiss** - 11:00 AM
I was having trouble finding the old exam solutions. where are they posted?

**Ujjwal Rehani** joined the conversation

**Eduardo Adum** - 11:00 AM
i have teh exam solutions just not hw 3 solutions

**Joshua Mpere** - 11:00 AM
where are the hw 3 solutions

**Mitchell Yum** - 11:01 AM
its in another folder

**Richard Chang** - 11:01 AM
I made a new folder for our sections. It's called "CMSC 341 Spring 2017 Share Chang"

**Scott Armiger** - 11:01 AM
Yeah, I found that, but only the exam solutions seem to be in it

**Richard Chang** - 11:01 AM
Also try this link: https://drive.google.com/drive/u/0/folders/0B5GywtKYtEzPdy1JTWZDVkUzT28

**Mitchell Yum** - 11:01 AM
yeah like there are two folders

**Robert Duguay** - 11:01 AM
I don't have permission

**Eduardo Adum** - 11:01 AM
the only thing in there is the exam solutions

**Brian D. Hanson, Jr.** - 11:01 AM
Only exam 1 is in that folder

**Richard Chang** - 11:01 AM
The hw3 solutions I made available to all sections, since we did the same homework.
That's here: https://drive.google.com/drive/u/0/folders/0B5GywtKYtEzPaUtIZ3A4M1BURzg

**Eduardo Adum** - 11:02 AM
found em

**Richard Chang** - 11:02 AM
Okay, let's start with the exam.

**Eduardo Adum** - 11:02 AM
look in the cmsc341 share all folder for hw3

**Robert Duguay** - 11:03 AM
Why don't i have permission to view these folders?

**Achuachua Tesoh-Snowsel** joined the conversation

**Richard Chang** - 11:03 AM
There's actually not that much material to test you guys on. So, most people shouldn't have to worry too much. I don't like making students memorize too much so you don't have to worry about what each STL class member functions do.

**Joel Okpara** - 11:03 AM
Are you logged in with UMBC account?

**Eduardo Adum** - 11:04 AM
Exam Question- What is the yellow bar on S3  Question 4 for?

**Robert Duguay** - 11:04 AM
Yes

**Ziheng Zhou** - 11:04 AM
will there be questions about AVL trees?

**Robert Duguay** - 11:04 AM
I've requested permission from the creator of the folder

**Richard Chang** - 11:05 AM
No AVL tree questions.

**Joshua Mpere** - 11:05 AM
will there be audio in this or are we just using the chat

**Yael Weiss** - 11:05 AM
Professor Park has a midterm review under his section - does that list of topics also apply to us - are those the topics that will be covered

**Richard Chang** - 11:05 AM
I made the documents public for now, so try the links
No, each sections exam topic is different. So, don't worry about Park's questions.

**Robert Duguay** - 11:05 AM
Works for me now

**Richard Chang** - 11:05 AM
No audio.

**Levan Sulimanov** - 11:06 AM
will we need to prove by induction and any other proofs?

**Richard Chang** - 11:06 AM
Back to exam. First part of the exam is True False.

**Aditya Kaliappan** - 11:06 AM
What about binary trees or trees in general?

**Scott Armiger** - 11:06 AM
Can we assume that the exam on thursday is going to be representative of the practice exam?  So like, Big Oh, upper bound of code fragment, some multiple choice on arrays, stack and ques, and writing code for a linked list?

**Jack Crissey** joined the conversation

**Richard Chang** - 11:07 AM
I'll go over what is fair game on exam that is not on the old exam. For example, Big Omega is not on the old exam but will be on Thursday's exam.

**Eduardo Adum** - 11:07 AM
So as a rule of thumb - Do we just look at the slowest operations like in Q(1-5) the slowest is O(n) and everthing after that will be true?

**Zulfekar Husain** - 11:07 AM
For the questions about O(n) functions are we doing the greatest function and all of the other faster growing functions as well? So nlogn would also be n^2, n^2, and 2^n.

**Juno Park** - 11:07 AM
what about big theta?

**Richard Chang** - 11:07 AM
People tend to lose a lot of points on True False and Multiple Choice. There's no partial credit on these, so be careful.
For the T/F, Big Oh questions, the idea is that you know that a function like 17n + 4 log n + 3 is dominated by the 17n term. So that function is O(n).

**Adam Snyder** - 11:09 AM
Right, and then it is also O(anything greater than n)?

**Richard Chang** - 11:09 AM
The problem with these questions is that many students said 17n + 4 logn + 3 is NOT O(n log n) and NOT O(n^2).

**Scott Armiger** - 11:09 AM
Would it be possible for you to post a compounded list of everything that is fair game on the test onto the website, so we can use it as a study guide?

**Richard Chang** - 11:10 AM
These are upper bounds, so it is mathematically true that 17n + 4 log n + 3 is O(n^2). It's just an upper bound that is a bad over estimate.
The problem with these questions was that if you made that one mistake, then you lost a lot of points.

**Arielle-Cherie Paterson** - 11:10 AM
For #3 in the T/F section, why is the big O nlogn instead of n?

**Richard Chang** - 11:10 AM
I gave some back.
Yes, n is O(n^2) and O(n^3) and O( anything bigger than n)
OK, will make a list of fair game topics and post on web later.

**Eduardo Adum** - 11:11 AM
cool

**Adam Snyder** - 11:11 AM
Thanks

**Eric Thompson** - 11:12 AM

thank you professor

**Iheanyi Phillips-Uwanamodo** joined the conversation

**Richard Chang** - 11:12 AM
The rest of the T/F questions are similar. Expect also to have Big Omega questions.
Oh, perfectly OK to guess on T/F questions. Don't leave any question blank.

**Adam Snyder** - 11:12 AM
Can we talk about how to calculate Big Omega?
It's the low bound, right?

**Robert Duguay** - 11:13 AM
I'm still confused as to how 17n+4logn+3 can be O^2 and O^3

**Joshua Mpere** - 11:13 AM
wait I don't understand #3 in the t/f section

**Ziheng Zhou** - 11:13 AM
limit

**Levan Sulimanov** - 11:13 AM
Because those are the overestimates of your Big Oh

**Joshua Mpere** - 11:13 AM
wouldn't that  just be O(n)

**Richard Chang** - 11:13 AM
@Arielle since n is less than n log n, it is mathematically true that n is O(n log n). Big Oh just means upper bound. The upper bound doesn't have to be tight.
If I asked you if n is Omega(n log n), then that is FALSE.

**Robert Duguay** - 11:14 AM
Ah, I get it.  It's an overestimate, but it's possible

**Richard Chang** - 11:14 AM
This is like asking if 3 < 100000000. The answer is "yes", but it doesn't mean 100000000 is a good estimate for the value of 3.

**Arielle-Cherie Paterson** - 11:14 AM
oh got it, thank you!

**Iheanyi Phillips-Uwanamodo** - 11:14 AM
@Richard campus WiFi is out so a lot of people can't get to this chat

**Adam Snyder** - 11:14 AM
It's working for me.
I'm on campus

**Richard Chang** - 11:15 AM
Big Omega is a lower bound.

**Iheanyi Phillips-Uwanamodo** - 11:15 AM
It's not working in my apartment

**Adam Snyder** - 11:15 AM
Did you try swapping to Eduroam?

**Joel Okpara** - 11:15 AM
I got wifi back late last night

**Richard Chang** - 11:15 AM
@Iheanyi will post a transcript on the web for when people have internet again.

**Iheanyi Phillips-Uwanamodo** - 11:16 AM
@Richard awesome thanks

**David Atlas** joined the conversation

**Richard Chang** - 11:18 AM
Okay, back to Big Omega: you can say that n^2 - 5 n is Omega(n^2) because the n^2 term dominates. Even though n^2 - 5n is actually less than n^2, the Omega() notation allows us to put a constant in front. So, if we pick c to be 1/1000, then it is obviously true that 1/1000 * n^2 < n^2 - 5n. So, n^2 is a lower bound for n^2 - 5n. That means we can say that n^2 - 5n is Omega(n^2).

**Nathan Jones** joined the conversation

**Eduardo Adum** - 11:18 AM
so say we are using the equations in Q1-5 but were asked the big omega. Would the true be O(logn) and O(n)?

**Richard Chang** - 11:18 AM
It is also true that n^2 -5n is O(n). Like before this is a bad lower bound.

**Aditya Kaliappan** - 11:19 AM
So then, you could technically say that all functions are lower bounded by omega(1)?

**Scott Armiger** - 11:19 AM
So omega is basically just asking what term dominates the equations?

**Zulfekar Husain** - 11:19 AM
And all of the slower functions are bad estimates for big omega?

**Richard Chang** - 11:19 AM
@Eduardo if we replaced Q1-5 with Omega( ) instead of O( ), then the answers would be TRUE, TRUE, FALSE, FALSE, FALSE

**Adam Snyder** - 11:20 AM
So then--if you ask us the Omega() of something, we can always answer Omega(1) and be correct?

**Richard Chang** - 11:20 AM
@Scott no. Both Omega and O() are asking about "dominates". Big Oh is upper bound, Big Omega is lower bound.

**Eduardo Adum** - 11:20 AM
Great so we look at the slowest notation aka 7n and everything faster is the omega and everything below is the big O

**Richard Chang** - 11:21 AM
@Zulfi slower functions = ??? smaller functions (as opposed to slower running time which is bigger numbers).

**Scott Armiger** - 11:21 AM
Alright, that makes sense got it

**Levan Sulimanov** - 11:21 AM
Wait, how It is also true that n^2 -5n is O(n)? Isn't it by definition that n^2-5n < n ?

**Richard Chang** - 11:21 AM
@Adam yes, but that kind of question should be "give the best lower bound on ..." in which case Omega(1) is not a good answer.

**Levan Sulimanov** - 11:22 AM
which means it is not BigO(n)?

**Richard Chang** - 11:22 AM
@Levan. Ooops meant n^2- 5n is Omega(n).

**Levan Sulimanov** - 11:22 AM
oh, cool! got it

**Richard Chang** - 11:23 AM
Are we good with the T/F section??

**Michael Sanchez** - 11:23 AM
yes

**Zulfekar Husain** - 11:23 AM
Yes

**Colin Bowen** - 11:23 AM
Good here.

**Eduardo Adum** - 11:23 AM
should be good

**Achuachua Tesoh-Snowsel** - 11:23 AM
No

**Robert Duguay** - 11:23 AM
Sure

**Aditya Kaliappan** - 11:23 AM
yes

**Scott Armiger** - 11:23 AM
Yes

**Achuachua Tesoh-Snowsel** - 11:23 AM
i am still confused please

**Joshua Mpere** - 11:23 AM
yes

**Eric Thompson** - 11:23 AM
five yes and one no

**Parth Patel** - 11:23 AM
yes

**Kyle Castle** - 11:24 AM
yes

**Adam Snyder** - 11:24 AM
yes

**Richard Chang** - 11:24 AM
@Achuachua hopefully campus is open tomorrow and you can ask more questions in office hours.

**Philip Magaletta** - 11:24 AM
yes

**Richard Chang** - 11:24 AM
Okay, moving on to multiple choice. These are asking about running times.

**Achuachua Tesoh-Snowsel** - 11:24 AM
Hopefully, thanks

**Richard Chang** - 11:25 AM
Basically, you should be familiar with running times of array and linked list operations, because that's all that we have done so far.

**Eduardo Adum** - 11:25 AM
my question is on the yellow highlight on #4
is that a correction or typo?

**Richard Chang** - 11:25 AM
we'll get to #4 in a sec

**Eduardo Adum** - 11:25 AM
okie dokie

**Achuachua Tesoh-Snowsel** - 11:25 AM
i still don't have access to the shared doc

**Aditya Kaliappan** - 11:25 AM
also, can we go over #1? I am not sure whether we know where to insert or not.

**Achuachua Tesoh-Snowsel** - 11:26 AM
i am still waiting for you to approve it

**Adam Snyder** - 11:26 AM
Did you make sure you were accessing it with your umbc gmail account?

**Richard Chang** - 11:26 AM
In Q1, you can just add an item to the end of the array, that should be O(1) since you don't have to make more space.

**Scott Armiger** - 11:26 AM
So not stacks/ques or binary trees?

**Richard Chang** - 11:26 AM
Try this link: https://drive.google.com/file/d/0B5GywtKYtEzPU2E4a0dWX25SR2M/view?usp=sharing

**Robert Duguay** - 11:26 AM
Is d) the answer to #2?

**Richard Chang** - 11:26 AM
No binary trees, but stack and queues are implemented using arrays and linked lists.

**Achuachua Tesoh-Snowsel** - 11:26 AM
it worked, thatns

**Zulfekar Husain** - 11:26 AM
Are all linked list operations for stacks O(1)?

**Aditya Kaliappan** - 11:27 AM
Couldn't Q1 also be O(n) assuming that you knew you had space but not the index of the last item

**Eric Thompson** - 11:27 AM
@Robert no cause with an array we can use binary search which reduces search time to O(logn)

**Richard Chang** - 11:28 AM
Okay, general rule for these questions. We are talking about a "good implementation" of the data structure. A bad programmer can always make a data structure slower by doing silly thiings. That's not what we are asking for.
So, for arrays, yeah you need to know how big your array is. For linked lists, use a tail pointer if that makes things faster.

**Aditya Kaliappan** - 11:28 AM
Okay, I got it now

**Richard Chang** - 11:29 AM

So, no the answer to Q1 isn't "a dumb programmer can turn this into a O(n) time operation."

**Eduardo Adum** - 11:29 AM
hahahaha

**Richard Chang** - 11:29 AM
#2. You *CAN* use binary search on arrays. So, the answer is not (a) or (d)
#2 still. Also not (b), so the answer is (c)

**Aditya Kaliappan** - 11:30 AM
Also, are the linked lists singly linked or doubly linked? Will we be tested on doubly linked lists?

**Scott Armiger** - 11:30 AM
So, does the same assumption go for question 5 where we have an answer that says "It takes O(n) to access the last item in a linked list" we can assume we have a end pointer?

**Richard Chang** - 11:30 AM
Will explicitly say doubly linked if that's what is being asked.

**Robert Duguay** - 11:30 AM
So what is the answer?

**Cassidy Crouse** joined the conversation

**Richard Chang** - 11:30 AM
#3. Adding and removing from front of a linked list is O(1), so answer is (d)

**Atijavansa Ok** joined the conversation

**Richard Chang** - 11:32 AM
#4. There's two answers because some students said that pushing can take O(n) if we run out of space in the array and have to allocate a bigger array and copy things over. I had intended the answer to be (d), because you can just add and remove from the end of an array in O(1).
@Robert ??? answer to what

**Zulfekar Husain** - 11:33 AM
Can we assume that space is allocated for all questions, unless you say otherwise?

**Robert Duguay** - 11:33 AM
#1.  My chat window glitched and I think I missed it

**Richard Chang** - 11:33 AM
@Zulfi I should make that explicit about arrays having space or not. I keep forgetting.

**Levan Sulimanov** - 11:33 AM
Q5. Why we choose answer to be *a*? I searched online and many people say and show how they implement binary search using linked list?

**Eduardo Adum** - 11:34 AM
what if we are asked about the push and pop of an array and linked list for a queue how would that work?

**Richard Chang** - 11:34 AM
#5 the answer is (a).

**Quentin Jones** joined the conversation

**Richard Chang** - 11:34 AM
You can't do binary search using a linked list. You don't know where the middle is.

**Scott Armiger** - 11:34 AM
Is that because we can assume that we have an end pointer? So it wouldnt thake O(n) to access that last element

**Richard Chang** - 11:35 AM
#5 answer is not (b) because you can use a tail pointer and it's not (c) because it is O(1) time make a new node.

**Aditya Kaliappan** - 11:35 AM
I guess you could count the number of nodes in the sorted linked list to find the size, and to access the middle, you start from the beginning or end pointer to count to the correct node. However, this may run in O(n) time and not the desired O(logn).

**Richard Chang** - 11:36 AM
@Scott you can ask in the exam "Can I assume the linked list has a tail pointer?" The worst thing I'll say is "You should know that" if I don't want to answer the question.
Any more questions on mutiple choice??

**Scott Armiger** - 11:36 AM
Alright, cool

**Adam Snyder** - 11:36 AM
Works for me

**Scott Armiger** - 11:36 AM
Yes

**Levan Sulimanov** - 11:36 AM
So all of them will be about running times?

**Ziheng Zhou** - 11:36 AM


**Scott Armiger** - 11:36 AM
I mean no

**Robert Duguay** - 11:36 AM
@Richard I still don't know what the answer to #1 is

**Zulfekar Husain** - 11:36 AM
Nope. I'm good with multiple choice.

**Scott Armiger** - 11:36 AM

Yes I'm good

**Achuachua Tesoh-Snowsel** - 11:37 AM
thanks

**Damon Streat** - 11:37 AM
#1 is a)

**Kyle Castle** - 11:37 AM
I'm good, thanks!

**Robert Duguay** - 11:37 AM
@Damon Thanks, that's what I thought

**Aditya Kaliappan** - 11:37 AM
I'm good.

**Robert Duguay** - 11:37 AM
Ok, I'm good

**Richard Chang** - 11:37 AM
@Robert #1 of MC is (a). Can you not see the highlighted answers in the exam?

**Yvonne Kamdem Manewa** - 11:37 AM
there's also an answe key on the shared documents page

**Achuachua Tesoh-Snowsel** - 11:37 AM
#1 O(1)

**Richard Chang** - 11:37 AM
@Juno that's why my phone rang!
@Eduardo missed your question. Not sure what you are asking.

**Robert Duguay** - 11:38 AM
@Richard My copy of the practice exam doesn't have the answers highlighted
Am I looking at the wrong one?

**Juno Park** - 11:38 AM
my bad :((

**Yvonne Kamdem Manewa** - 11:39 AM
there's separe file, wi the answers

**Richard Chang** - 11:39 AM
are you using this document? https://drive.google.com/file/d/0B5GywtKYtEzPU2E4a0dWX25SR2M/view?usp=sharing

**Yvonne Kamdem Manewa** - 11:39 AM
*separate

**Robert Duguay** - 11:39 AM
I wasn't, but I am now.  Thanks

**Eduardo Adum** - 11:40 AM
so take question3 and 4 of s3 but replace stack with queue
how would the answer change?

**Richard Chang** - 11:40 AM
@Eduardo you can't just ask about running times of "queue" and "stack" since the running times depend on the actual implementation. So, have to say "stack using array" or "queue using singly-linked list". In any case, a good implementation of queue and stack should have add and remove in O(1) time.

**Scott Armiger** - 11:40 AM
I think we went over stacks didn't we?

**Levan Sulimanov** - 11:40 AM
So multiple choice are about running times of problems with queues, linked lists, arrays, and stacks?

**Richard Chang** - 11:41 AM
@Levan not necessarily. MC and TF are just to make grading easier.

**Adam Snyder** - 11:41 AM
What can we expect from the coding problems?

**Aditya Kaliappan** - 11:41 AM
What do we have to know about the STL if we do not have to know member class functions?

**Levan Sulimanov** - 11:41 AM
got it, Thanks

**Richard Chang** - 11:41 AM
Okay, moving on to Section 3 running times.
@Adam no STL on exam. Assuming that you have Google for the rest of your life and can look these up whenever you want to.

**Achuachua Tesoh-Snowsel** - 11:42 AM
by STL what do you mean

**Richard Chang** - 11:42 AM
Section 3 questions are identical to the ones in HW3, I think

**Achuachua Tesoh-Snowsel** - 11:42 AM
no trees, Graphs?

**Matt Smith** - 11:43 AM
Number 2 on running times inner loop doesn't effect "i" so how is it nlogn

**Eduardo Adum** - 11:43 AM
Comp Sci Majors only need to know the material for the test. for any point after we have google

**Richard Chang** - 11:43 AM
STL = standard template library. That's what you used in Proj2

**Scott Armiger** - 11:43 AM
Can we expect them to be similar on the exam as well?

**Richard Chang** - 11:43 AM
No trees, no graphs.
Yes, similar type running time questions on Thursday

**Aditya Kaliappan** - 11:43 AM
Would we have to find out the lower bound running time given some code, and if so, how?

**Richard Chang** - 11:44 AM
#1 is log n, any questions?

**Robert Duguay** - 11:44 AM
@Richard So al you're looking for in an explanation is a few sentences?

**Scott Armiger** - 11:44 AM
Overall can we expect the exam on Thursday to be reflective of this one? Same types of questions plus big omega?

**Richard Chang** - 11:44 AM
@Aditya yeah that would be a good question to ask for lower bound

**Ziheng Zhou** - 11:44 AM
Can I just put log n instead of O(logn)?

**Zulfekar Husain** - 11:44 AM
t is assigned to i, so for every iteration it is half of that. So, it makes it logn. @Matt.

**Juno Park** - 11:44 AM
what if t = t / 3 instead of  t = t/2?

**Richard Chang** - 11:45 AM
@Scott yes. Besides some additional items like Omega()
@Ziheng question explicitly says to use O() notation

**Robert Duguay** - 11:45 AM
@Juno I think that would be log base 3

**Damon Streat** - 11:45 AM
^

**Juno Park** - 11:45 AM
k that make sense
ty

**Yvonne Kamdem Manewa** - 11:46 AM

what would the answer be for omega?

**Richard Chang** - 11:46 AM
@Juno Still O(log n) if we use t = t/3

**Matt Smith** - 11:46 AM
i is given to t and shouldn't effect i though right?

**Aditya Kaliappan** - 11:46 AM
@Richard How do we approach estimating the lower bound of some code?

**Adam Snyder** - 11:46 AM
What would be the Omega() of that code?

**Matt Smith** - 11:46 AM
Making it a n^2 nested loop

**Richard Chang** - 11:46 AM
@Yvonne For #1 it is Omega(log n) as well

**Aditya Kaliappan** - 11:47 AM
Note: you can convert from log base 2 to log base anything by a constant factor, so it should not matter if t = t/3

**Scott Armiger** - 11:47 AM
When is the big omega not the same as the big Oh?

**Richard Chang** - 11:47 AM
Okay, I think we've moved on to #2

**Zulfekar Husain** - 11:47 AM
The i part is O(n), but the t part is logn becuse it is half of the iterations of i.

**Brian D. Hanson, Jr.** - 11:48 AM
Does n for #1 just represent an arbitrary input size
?

**Matt Smith** - 11:48 AM
So now
t = I
And
I = t mean the same thing?

**Richard Chang** - 11:48 AM
@Scott we are happy if we can estimate the running time with same function O( f(n)) and Omega( f(n) ). But sometimes the runnign time is difficult to estimate and we only get Omega( f1(n) ) and O( f2(n) ) where f1 < f2. The closer we can get f1 and f2 to be, the happier we are.

**Brian D. Hanson, Jr.** - 11:48 AM
@Richard

**Richard Chang** - 11:48 AM
Yes we are thinking of n as the input size.
Okay,.... #2

**Aditya Kaliappan** - 11:49 AM
@Richard How do you estimate big Omega for a code snippet?

**Richard Chang** - 11:49 AM
Inner loop takes at most log n time. That's an upper bound because i can be at most n. The outer loop takes n iterations. So, total time can't be worse than O(n log n).

**Nathan Jones** - 11:51 AM
Would Omega of that one be constant time assuming an input of 0?

**Matt Smith** - 11:51 AM
Input of 1 or zero just skips the second loop

**Richard Chang** - 11:52 AM
If we wanted lower bound, then think about the situation with the inner loop when i is greater than n/2. Then, the inner loop will take at least log(n/2) iterations. We know from algebra that log(n/2) = (log n) - 1. There are n/2 iterations where i is at least n/2, so the lower bound is (n/2) * ( log(n) - 1) = 1/2*n*log n - 1/2*n. This is lower bounded by Omega(n log n).
So, if I were to ask about lower bounds for #2, the answer is Omega(n log n). That also tells you that the upper bound of O(n log n) is tight.

**Matt Smith** - 11:52 AM
Seems like t has no effect on the algorithm but okay

**Richard Chang** - 11:53 AM
@Nathan we don't think about running times that way.
@Matt since we are trying to analyze the running time in terms of n, we are deliberately trying to remove the dependence of the running time on t.

**Kyle Roberts** joined the conversation

**Richard Chang** - 11:54 AM
Okay #3. This is the question of much debate in HW3.
The answer is O(n) because the inner for loop doesn't take n iterations all the time. In fact the inner for loop's iterations decreases by half for each iteration of the outer loop.

**Joshua Mpere** - 11:56 AM
somthing++ would dominate the function to O(n)

**Richard Chang** - 11:56 AM
So, the running time is n + n/2 + n/4 + ... < 2n. That gives O(n) total time.

**Ziheng Zhou** - 11:56 AM
I thought this one is n factorial
I mean summation

**Richard Chang** - 11:56 AM
@Ziheng no!

**Colin Bowen** - 11:57 AM
Yeah I got n log n on that one because I didn't think about it long enough, dang.

**Richard Chang** - 11:57 AM
For the exam, since it is time limited, last semester, I did not deduct if students said O( n log n). For HW3 this semester, you have time to think this one through, it will be -1 for O(n log n)

**Matt Smith** - 11:57 AM
So is O(nlogn) wrong?

**Zulfekar Husain** - 11:57 AM
Could it also be nlogn too. Because it would go through all the iterations of i, and then cut in half for t making it logn.

**Richard Chang** - 11:58 AM
O(n log n) is not the best answer. It is a legit upper bound.

**Joshua Mpere** - 11:58 AM
O(n) makes sense

**Aditya Kaliappan** - 11:58 AM
@Richard For Q3, if you were to ask Omega, then would it be Omega(n) because considering t > n/2, the inner loop runs only n times, and so there is 1 iteration where the inner loop executes n times? Then in this case, the code fragment is tightly bounder?

**Matt Smith** - 11:58 AM
Why does the book say worst case scenario for Big O?

**Richard Chang** - 11:59 AM
If we want to do Omega() for #3, the inner loop takes n iterations when t = n. That's enough to claim that the total running time is Omega(n). The other iterations will just take even more time.
If you tried to argue that #3 is Omega(n log n) you will (should) fail. That might give you a clue that O(n log n) was not the best upper bound.

**Joshua Mpere** - 12:00 PM
is theta also fair game or no ?

**Richard Chang** - 12:00 PM
@Joshua Theta just means the function is both Big Oh and Big Omega. Let's skip it for now.

**Juno Park** - 12:01 PM
yay!

**Aditya Kaliappan** - 12:01 PM
@Richard How would you argue that #3 is not Omega(nlogn)?

**Richard Chang** - 12:01 PM
@Matt we are usually analyzing the worst case running time of an algorithm. In the code snippets here, there' no

"worst case" because we just have one case.
@Aditya you give a lower upper bound. If the running time is bounded above by O(n), it can't also be bounded below by Omega(n log n)
Okay, moving on to #4

**Aditya Kaliappan** - 12:03 PM
Ok, thanks!

**Matt Smith** - 12:03 PM
Skip lol

**Richard Chang** - 12:03 PM
I said in class "this is a trick question" when I handed out the exam last semester. Maybe some students didn't believe me. Maybe they thought that announcing it as a trick question was itself the trick. I wasn't really trying to be that tricky.
So, basically the while loop is never entered, so the running time does not depend on n. In that case we call it O(1) for constant time.
You can say O(5) if you want to, but nobody says that.

**Zulfekar Husain** - 12:04 PM
Got it.

**Richard Chang** - 12:04 PM
OTOH, you can't say O(zero) because then mathematically not true.
moving on to coding.

**Aditya Kaliappan** - 12:05 PM
So, even if this loop had some exponential runtime algorithm in it, you still can say that it is both O(1) and Omega(1)?

**Adam Snyder** - 12:05 PM
what's OTOH?

**Matt Smith** - 12:05 PM
We accept NULL?

**Richard Chang** - 12:05 PM
OTOH = On The Other Hand

**Adam Snyder** - 12:05 PM
Got'cha

**Richard Chang** - 12:06 PM
@Aditya if the loop is never executed, then it doesn't matter what the body of the loop does.

**Aditya Kaliappan** - 12:06 PM
Ok, I'm good.

**Ziheng Zhou** - 12:06 PM
The loop might be executed if n is negative

**Matt Smith** - 12:06 PM

Nope
Tried that

**Kyle Roberts** - 12:06 PM
How can the function 17n + 4logn + 3 be O(n) and O(nlogn)?

**Matt Smith** - 12:06 PM
-5 > -25

**Aditya Kaliappan** - 12:07 PM
Also, n refers to a large positive value (approaching infinity)

**Richard Chang** - 12:07 PM
@Ziheng yeah, a couple of students said that in the exam. I gave them points if they thought n was negative. But it would have been better if they asked during the exam. We usually use n for the input size, which can't be negative.

**Kyle Roberts** - 12:07 PM
Actually, 1-5 on the exam is all true but it's the same equation..

**Richard Chang** - 12:07 PM
For the coding questions, I don't want to go over this line by line. You should be prepared to write code for linked lists.

**Levan Sulimanov** - 12:08 PM
one question, how will the question be formed if you will ask in Running Time section about Big Omega?

**Richard Chang** - 12:08 PM
@Kyle scroll back we had long discussions on T/F already.
@Levan I would ask you to estimate the *lower bound* on the running time.

**Zulfekar Husain** - 12:09 PM
One question regarding question 2. Can you copy a new node without dereferencing the *ptr pointer.

**Richard Chang** - 12:09 PM
For coding questions, don't worry too much about syntax. I'm not going to take off for missing semi-colon. I want to see that you can code linked lists in C++.

**Scott Armiger** - 12:10 PM
Would we be asked to implement doubly linked lists on the exam? Because I know some of us (myself included) actually never dealt with them in 202

**Richard Chang** - 12:11 PM
@Zulfi at some point you have to dereference the pointer to get to a node. Not sure what you mean.

**Zulfekar Husain** - 12:11 PM
Should we worry about doubly linked lists too for coding questions?

**Aditya Kaliappan** - 12:11 PM
Also, on the coding, if we are to code question 1, which is then used in question 2, if question 1 does not work, will you still assume that question to uses the correct implementation of it? Also, can we assume that the class definition methods will work as expected even if we are not to implement them on the exam?

**Richard Chang** - 12:11 PM
@Scott let's say no doubly linked list in coding because that's hard to grade. Also, easy to mix up pointers.

**Scott Armiger** - 12:11 PM
Alright, awesome. Thank you.

**Aditya Kaliappan** - 12:12 PM
I looked at question 2 where you set the next pointer to NULL, but ideally, wouldn't you have done this in the constructor?

**Adam Snyder** - 12:12 PM
neato

**Richard Chang** - 12:12 PM
@Aditya I would assume that your implementation of List::count() is correct even if you messed it up in #1.
@Aditya The copy constructor should copy the Node exactly, so that would also copy the next pointer.
If I said Node *cptr = new Node(ptr->data) then maybe the constructor would make the next pointer NULL.
Should I give a question on recursion? That was on HW2.

**Matt Smith** - 12:15 PM
Should you?

**Joshua Mpere** - 12:15 PM
no recursion

**Achuachua Tesoh-Snowsel** - 12:15 PM
it depends. if you tell us the question then yes

**Zulfekar Husain** - 12:15 PM
No.

**Atijavansa Ok** - 12:15 PM
nah

**Aditya Kaliappan** - 12:15 PM
Recursion in what context?

**Richard Chang** - 12:15 PM
Well, the bad part is you would have to do recursion. The good part is that there are more questions with partial credit on the exam.
Like write a function with recursion that does ...

**Matt Smith** - 12:16 PM
So no?
Nooooo

**Scott Armiger** - 12:16 PM
How about make it extra credit 😀

**Atijavansa Ok** - 12:16 PM
^

**Aditya Kaliappan** - 12:16 PM
Extra credit is a good idea

**Adam Snyder** - 12:16 PM
I'm not horribly against recursion

**Matt Smith** - 12:16 PM
Recursion requires box tracing

**Robert Duguay** - 12:16 PM
Are you referring to question 4 from the homework where we were randomly printing out a linked list?
hw2

**Richard Chang** - 12:17 PM
yeah something like hw2 questions

**Levan Sulimanov** - 12:17 PM
let it be extra credit

**Richard Chang** - 12:17 PM
I'll think about extra credit. More to grade.

**Damon Streat** - 12:17 PM
Are there going to be around the same number of questions on our exam as this practice one?

**Aditya Kaliappan** - 12:17 PM
@Richard Will it be recursion in regards to linked lists or recursion in general?

**Richard Chang** - 12:17 PM
Let's leave recursion for Exam 2. It is really useful with Binary Search Trees. The questions will be more natural.

**Matt Smith** - 12:18 PM
Cheers

**Richard Chang** - 12:18 PM
@Damon yes, this test was a bit on the short side, but that's OK.

**Achuachua Tesoh-Snowsel** - 12:18 PM
Thanks Dr.

**Richard Chang** - 12:18 PM
Should we move on to Homeowrk 3??
Here's the link to the solutions to HW3:
https://drive.google.com/file/d/0B5GywtKYtEzPdUxtRmhyaUhoVjA/view?usp=sharing
#1 should be pretty straightforward. Some of the functions were equivalent. I told the graders that you guys can put those in any order.

#2 you have to pull out a calculator.

**Aditya Kaliappan** - 12:20 PM
Do we have to do anything like #2 on the exam?

**Matt Smith** - 12:21 PM
When do we get any projects graded for point of reference?

**Richard Chang** - 12:21 PM
No, #2 is not a good exam question.
Project 1 is nearly done. Project 2 not yet started.

**Robert Duguay** - 12:22 PM
The questions under #3 look similar to what we just went over on the exam

**Matt Smith** - 12:22 PM
The "be paranoid" programming style is working

**Richard Chang** - 12:22 PM
For the n log n row, in Question #2, I wrote a quick Python function and tried numbers until I got close.

**Aditya Kaliappan** - 12:22 PM
They are the same.
For question 2, I just used Wolfram Alpha.

**Richard Chang** - 12:23 PM
Some difference in part d, but same answer.

**Yvonne Kamdem Manewa** - 12:23 PM
same (wolfram)

**Richard Chang** - 12:23 PM
Points for being resourceful.

**Levan Sulimanov** - 12:23 PM
do we need to prove something on the exam? Induction?

**Yvonne Kamdem Manewa** - 12:24 PM
please no proving, mercy?

**Richard Chang** - 12:24 PM
Questions #4 and #5, the point is that you understand that the mathematical definition of O() and Omega() requires picking the constants c and n_0. The arithmetic is actually pretty trivial.

**Aditya Kaliappan** - 12:24 PM
Also, for the Big O / Omega questions, do we need to show any mathematical derivation, or is knowing the order of function growth fine?
I meant on the T/F of the exam.

**Richard Chang** - 12:24 PM
For Q5, I meant to ask 1/100 * n^2 is Omega(n log n) but I forgot the 1/100.
@Aditya you don't have to provide any justification for T/F

**Joshua Mpere** - 12:25 PM
probst not induction since it wasn't needed on the hw

**Richard Chang** - 12:25 PM
No induction on Exam 1. We'll save it for Exam 2

**Joshua Mpere** - 12:25 PM
yay

**Levan Sulimanov** - 12:26 PM
any other proofs?

**Richard Chang** - 12:26 PM
But we'll have some induction on Exam 2. Induction is very natural for Binary Search Trees. So, if up to now, you've been saying "what the heck is induction/recursion good for???" Thinking about binary search trees might answer that.
No other proofs.
Any other questions???

**Robert Duguay** - 12:27 PM
Not from me

**Joshua Mpere** - 12:27 PM
will we have to make a copy constructor in c++
like with pointers

**Aditya Kaliappan** - 12:27 PM
When will you post the general list of topics of the exam on the course website?

**Richard Chang** - 12:28 PM
yeah copy constructor is fair game

**Brian D. Hanson, Jr.** - 12:28 PM
How soon can study guide be made?

**Richard Chang** - 12:28 PM
I'll post by this afternoon.

**Adam Snyder** - 12:28 PM
Cool cool

**Richard Chang** - 12:28 PM
What is this "study guide" that you speak of?

**Yael Weiss** - 12:28 PM
for number 3 letter c of HW why is the answer n as opposed to nlogn

**Brian D. Hanson, Jr.** - 12:28 PM
The list of general topics*

**Richard Chang** - 12:28 PM
@Yael scroll back we had a long discussion.

**Aditya Kaliappan** - 12:28 PM
Also, will the implementation of the linked list be with pointers, or the "object oriented" approach of a LinkedList object with a Node member?

**Richard Chang** - 12:29 PM
It was the same as old exam.

**Levan Sulimanov** - 12:29 PM
if that will be possible can you list some practice coding topics? Like make a function that deletes all doubles in linked list and ect?
Thank you!

**Richard Chang** - 12:29 PM
@Aditya pointers
@Levan but then I won't have any good questions for the exam. You want me to save the good questions for the exam.
Okay, we've been at this for an hour and a half. Let me save & post the transcript and eat some lunch and look over what I promised and post a list of "fair game" topics.

**Edgar Courtemanch** joined the conversation

**Richard Chang** - 12:31 PM
Oh and I have to make an exam or two.

**Robert Duguay** - 12:31 PM
Thanks for the review

**Kyle Castle** - 12:31 PM
Thanks!

**Achuachua Tesoh-Snowsel** - 12:31 PM
thanks Dr. Chang

**Aditya Kaliappan** - 12:31 PM
Thanks!

**Yvonne Kamdem Manewa** - 12:31 PM
thank you

**Scott Armiger** - 12:31 PM
Thanks!

**Brian D. Hanson, Jr.** - 12:32 PM
Thanks

**Scott Armiger** - 12:32 PM
God speed my friends!

**Atijavansa Ok** - 12:32 PM
Thank youuu!!!!! 😀

**Juno Park** - 12:32 PM
thank you so much~~

**Zulfekar Husain** - 12:32 PM
Thanks!!!

**Richard Chang** - 12:32 PM
Oh and I have to shovel. Forgot about that 😛

**Juno Park** - 12:32 PM
same rip:(

**Achuachua Tesoh-Snowsel** - 12:32 PM
could help you if i could drive

**Adam Grosse** - 12:33 PM
thank you

**Adam Snyder** - 12:36 PM
Thanks

**Do Hyun Kim** left the conversation

**Joshua Mpere** left the conversation

**Asebot Abebe** joined the conversation

**Alex Flaherty** - 1:01 PM


**Anqi Cheng** joined the conversation

**Anqi Cheng** joined the conversation

**Levan Sulimanov** - 1:10 PM
Thanks for the review!