University of Nevada, Reno

Welcome to CS 302 Data Structures

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Previously in CS 202

- The history of computing / objects / types / console I/O
- Operators / loops / methods / parameter passing
- Selection statements / arrays / strings
- Exceptions / debugging
- File input / file output
- Pointers / unsafe code / linked lists
- Collections / multi-dimensional arrays / search algorithms
- Sorting algorithms
- Object-oriented design / polymorphism / interfaces / inheritance
- Abstract class

CS 202 - Computer Science II

These were the basics of programming

- The ability to manipulate the computer to perform the required tasks

You saw data storage techniques:

- Arrays, and
- Linked lists (collections were discussed)

You saw array accessing/manipulation techniques:

- Searching, and
- Sorting

CS 302 – Data Structures

In this course, we will look at:

- *Algorithms* for solving problems efficiently
- *Data structures* for efficiently storing, accessing, and modifying data

We will see that all data structures have trade-offs

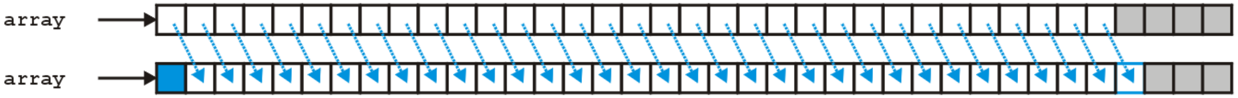
- There is no *ultimate* data structure...
- The choice depends on our requirements

CS 302 – Data Structures

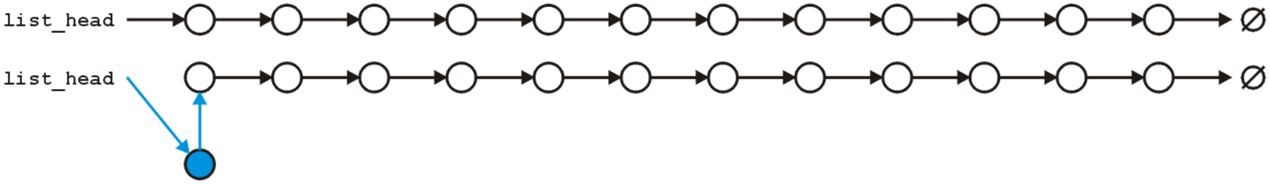
- **Consider accessing the kth entry in an array or linked list**
  - In an array, we can access it using an index `array[k]`
  - We must step through the first $k - 1$ nodes in a linked list
- **Consider searching for an entry in a sorted array or linked list**
  - In a sorted array, we use a fast binary search
    - Very fast
  - We must step through all entries less than the entry we're looking for
    - Slow

CS 302 – Data Structures

- **However, consider inserting a new entry to the start of an array or a linked list**
  - An array requires that you copy all the elements in the array over
    - Slow for large arrays



  - A linked list allows you to make the insertion very quickly
    - Very fast regardless of size

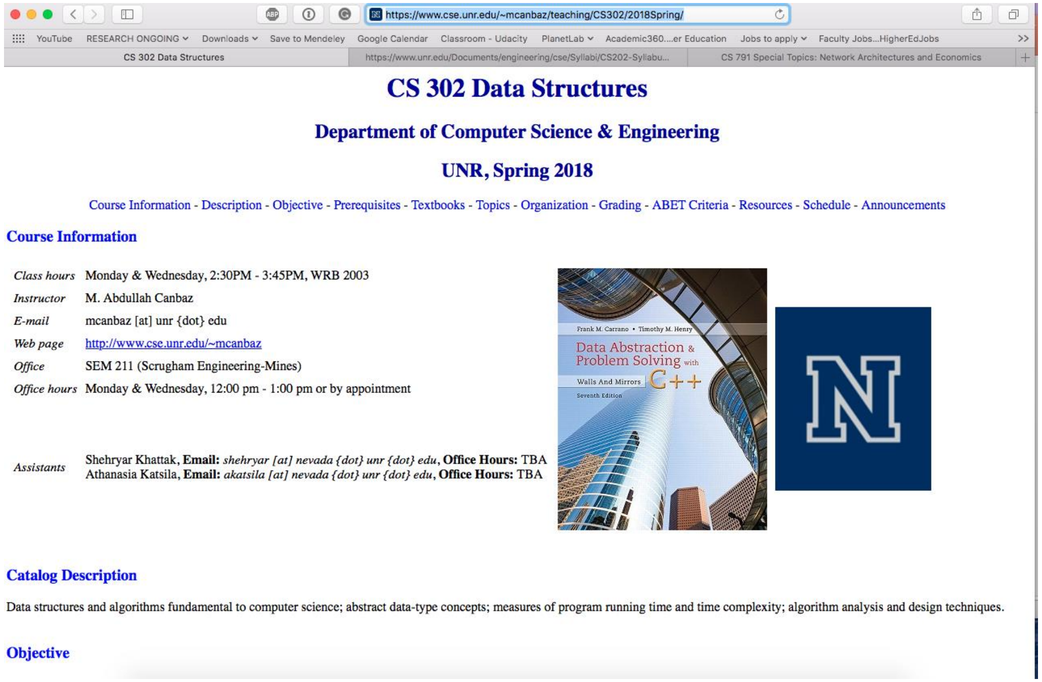


CS 302 – Data Structures

- **All course-related material on the course web site**

  https://www.cse.unr.edu/~mcanbaz/teaching/CS302/2018Spring/

- **This includes:**
  - Contact Information
  - The Course Outline
  - Various tutorials
  - Lecture Material
  - Lecture Topics
  - Assignments
  - Examination Details


https://www.cse.unr.edu/~mcanbaz/teaching/CS302/2018Spring/
YouTube
RESEARCH ONGOING
Downloads
Save to Mendeley
Google Calendar
Classroom - Udacity
PlanetLab
Academic360....er Education
Jobs to apply
Faculty Jobs...HigherEdJobs
CS 302 Data Structures
https://www.unr.edu/Documents/engineering/cse/Syllabi/CS202-Syllabu...
CS 791 Special Topics: Network Architectures and Economics
Frank M. Carrano • Timothy M. Henry
Data Abstraction & Problem Solving with C++
Walls And Mirrors
Seventh Edition

CS 302 Data Structures

Department of Computer Science & Engineering

UNR, Spring 2018

Course Information - Description - Objective - Prerequisites - Textbooks - Topics - Organization - Grading - ABET Criteria - Resources - Schedule - Announcements

Course Information

Class hours	Monday & Wednesday, 2:30PM - 3:45PM, WRB 2003
Instructor	M. Abdullah Canbaz
E-mail	mcanbaz [at] unr {dot} edu
Web page	http://www.cse.unr.edu/~mcanbaz
Office	SEM 211 (Scrugham Engineering-Mines)
Office hours	Monday & Wednesday, 12:00 pm - 1:00 pm or by appointment
Assistants	Shehryar Khattak, **Email:** *shehryar [at] nevada {dot} unr {dot} edu*, **Office Hours:** TBA Athanasia Katsila, **Email:** *akatsila [at] nevada {dot} unr {dot} edu*, **Office Hours:** TBA

Catalog Description

Data structures and algorithms fundamental to computer science; abstract data-type concepts; measures of program running time and time complexity; algorithm analysis and design techniques.

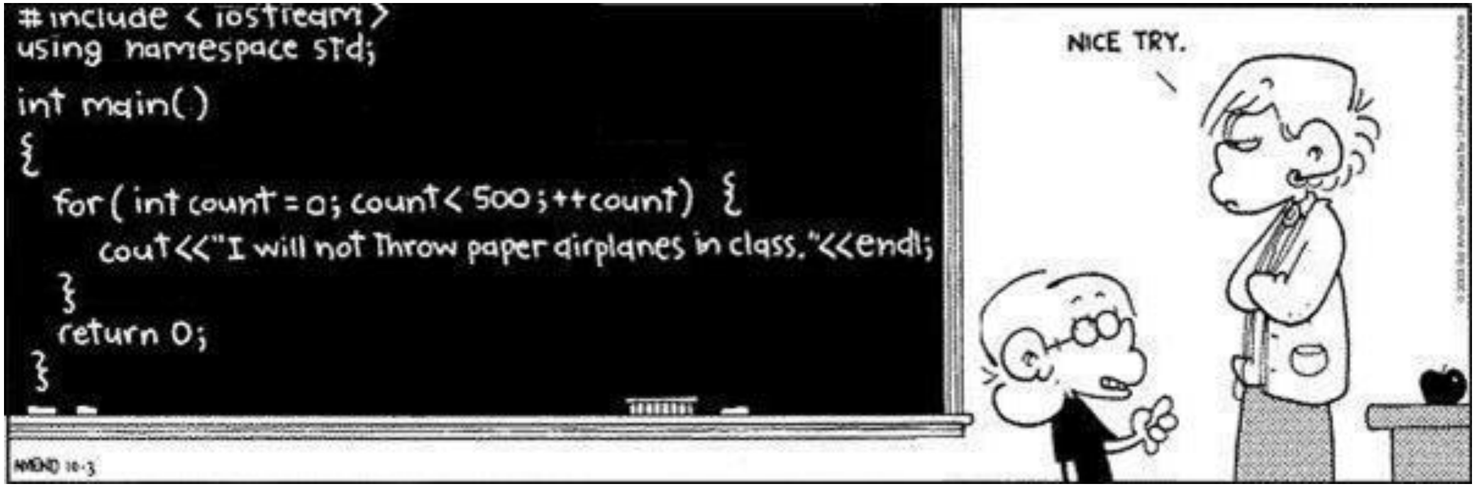
Objective

Classroom Etiquette

The classroom is not for watching the next football match —even if your country is playing— but you are welcome to sit outside

C++

You will be using the C++ programming language in this course



```
#include < iostream >
using namespace std;
int main()
{
  for (int count=0; count< 500;++count) {
     cout<<"I will not Throw paper airplanes in class."<<endl;
  }
  return 0;
}
```

Modified for C++ from http://www.foxtrot.com/

C++

- **This course does not teach C++ programming**
  - You will use C++ to demonstrate your knowledge in this course

- **One lecture covers:**
  - Features of C++ and differences with from other languages

- **An on-line tutorial is available on the course web site**
  - It assumes minimal knowledge of programming

C++

- **Other sources of help in C++ are:**
  - T.A.s,
  - The instructor
  - Other online tutorials: **`http://www.cplusplus.com/`**

Evaluation

- **The course is divided into numerous topics**
  - Storing ordered and sorted objects
  - Storing an arbitrary collection of data
  - Graphs
  - Algorithm Design Techniques

- **There will be bonus questions(Midterm and Final) and Assignments**

Evaluation

- **Your evaluation in this course is based on three components:**
  - 7 Programming Assignments (+1 Bonus)
  - 10 Quizes (+2 Bonus)
  - One mid-term examination
  - One final examination
- **You must pass both the examination component and the assignment component separately in order to pass the course**
  - If you fail either component, your grade is the lesser of the two
  - Handing in no projects will result in a grade of zero

Evaluation

- **Your grade is calculated according to the formula:**

42 - Programming Assignments (7 of 8)
10 - Quizzes (10 of 12)
22 - Midterm Exam
26 - Final Exam

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100 - Total Grade

Evaluation

- **A student who misses either examination must provide:**
  - A Verification of Illness form indicating a severe illness, or
  - Other formal documentation, as appropriate
- **There will be no re-weighting of the mid-term examination under any circumstances**

Evaluation

- **Commenting code is necessary for engineers:**
  - Engineers who do not comment code will not encourage employees and contracted programmers to comment their code
  - This will lead to significant additional costs

- **The commenting bonus occurs at the end of the term**
  - Coming up Next: Doxygen Lecture

Programming Assignments

- **For each of the eight projects, you will be required to implement one or more of the data structures taught in class**

- **The times the assignments are due is fixed:**
  - Right before the next assignment is available
  - The drop-box will be kept open until midnight for late submissions
  - First 2 hours of late submission: Maximum grade reduced to 70

Programming Assignments

- **You are responsible for the naming convention on the submitted file *unr-net-id* _a*M*.tar.gz**
- **where:**
  - *unr-net-id* is your UNR Net ID,
  - *M* is the number of the project
- **The execution must always be of the form**

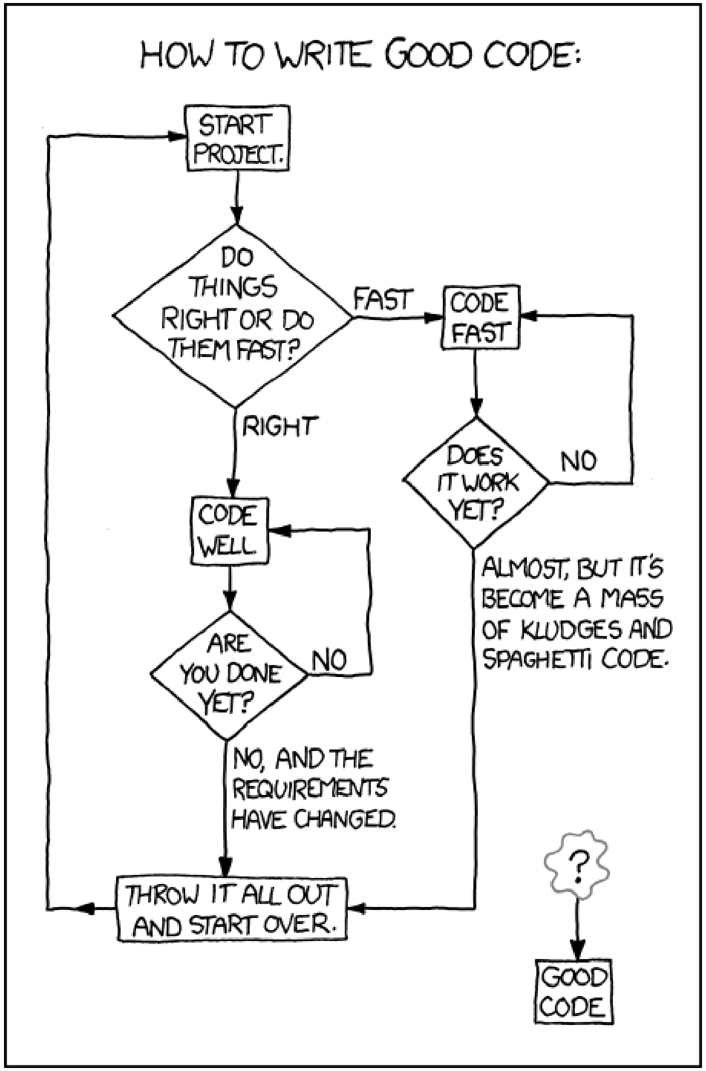
```
tar -cvf unr-net-id_aM.tar file1.h file2.h etc.h
```

  - `gzip unr-net-id_aM.tar`

- **README is required!!**

Programming Assignments

Even *xkcd* has some advice on coding...


HOW TO WRITE GOOD CODE:
START PROJECT.
DO THINGS RIGHT OR DO THEM FAST?
FAST
CODE FAST
DOES IT WORK YET?
NO
ALMOST, BUT IT'S BECOME A MASS OF KLUDGES AND SPAGHETTI CODE.
RIGHT
CODE WELL.
ARE YOU DONE YET?
NO
NO, AND THE REQUIREMENTS HAVE CHANGED.
THROW IT ALL OUT AND START OVER.
?
GOOD CODE

http://xkcd.com/844/

Improving Your Performance

The human brain can retain approximately 5-9 independent items of information in its short-term memory

George Miller, *The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information*, Psychological Review, Vol.63 pp.81–97, 1956

The introduction of new information causes the brain to discard an item currently in your short-term memory

- For example, consider the 12 words which will appear on the next sequence of screens

Your goal: at the end, write down all twelve words

Improving Your Performance

Cat

Improving Your Performance

Ultimate

Improving Your Performance

Knife

Improving Your Performance

Asteroid

Improving Your Performance

Motion

Improving Your Performance

Shipwreck

Improving Your Performance

Peach

Improving Your Performance

Ford

Improving Your Performance

Pencil

Improving Your Performance

Gum

Improving Your Performance

Curtain

Improving Your Performance

Forever

Improving Your Performance

- **Now, write down as many of these words as you can**
  - Most of you will be able to write down somewhere between 7 through 9 of these
  - It may even be possible to remember more new topics, however, you will note that there is no relationship between these objects

Improving Your Performance

- **To transfer information from your short-term memory to your long-term memory, that information must be imposed on your mind at least three times**
- **You should always try the following:**
  - Look at the slides before class
  - Attend lectures
    - You see the information again with commentary
  - Review the lecture during the evening
    - Rewrite and summarize the slides in **your** words

Improving Your Performance

- **In addition to this, you should:**
  - Get a reasonable nights sleep (apparently this is when information is transferred to your long-term memory), and
  - Eat a good breakfast (also apparently good for the memory)

Improving Your Performance

- **Like other courses, this course builds on previous information**
  - I will not answer questions about material which I have either previously covered or indicated that you are required to read

- **Also, neither the T.A.s nor myself will be available for help either on the day of the mid-term or final examinations**
  - There is no help which can be derived in that time, and therefore, to impress this upon you, you must study before-hand if you believe you will need help

Academic Offences

- **Academic Offences include, but are not limited to:**
  - **Infringing unreasonably** on the work of other members
    - E.g., disrupting classes
  - **Cheating**
  - **Plagiarism**
  - **Misrepresentations**

- **All students must read the Webpage**
  - Especially the “Organization” section

Plagiarism

- **All work must be done individually:**
  - You may not copy code directly from any other source
  - If you viewed another code (from books or lecture notes), you must include a reference in your project
  - You may not share code with any other students by transmitting completed functions to your peers
    - This restriction includes—but is not limited to—electronic and hard-copy sharing
  - You may discuss projects together and help another student debug his or her code; however, you cannot dictate or give the exact solution

Plagiarism

- **Collaboration with other students must be limited to**
  - Discussions
  - High-level pseudocode
  - Assistance with debugging (only through the offering of advice)
  - Sharing test files

- **All such collaborations must be documented in your source code**

Plagiarism

When one student copies from another student, both students are responsible

- Exceptions are made for outright theft

The penalty for plagiarism on an assignment is a mark of 0 on the assignment in question and a further 20% is subtracted from your final grade

- With notification sent to the necessary parties in the department

Plagiarism: Example 1

- Alex and Bailey were lab partners in CS 202
- Bailey left herself logged on Unix to allow Alex to complete the lab
- Alex copied Bailey’s CS 302 project

Plagiarism: Example 2

- Leslie asked if Morgan could send her his code so that she could look at it (promising, of course, not to copy it)
- Morgan sent the code
- Leslie copied it and handed it in

Plagiarism: Example 3

- **Erin did not chance her default password**
- **Fanny logged onto Erin's account and took Erin's code**
  - Erin is still responsible

Plagiarism: Example 4

- Garry and Harry worked together on a single source file initially and then worked separately to finish off the details
- The result was still noticeably similar with finger-print-like characteristics which left no doubt that some of the code had a common source

Plagiarism: Example 5

- **Jordan uploaded the projects to GITHUB.com without setting appropriate permissions. Kasey found this site, downloaded the projects and submitted them. Both are guilty.**
  - This applies to any public forum, news group, *etc*., not just gitub.com…

Plagiarism

- **The minimum penalty for plagiarism is 0 on the assignment and –20% on your final mark for each case of plagiarism**
  - the penalty is applied regardless of what proportion the assignment are of your final grade
- **A student who cheats must receive a grade lower than a student who did not hand in an assignment**

Plagiarism

- **The best way to avoid plagiarism is:**
  - review the C++ tutorial
  - read the assignment as soon as it is available
  - start the assignment so that there is sufficient time to contact the T.A. or myself if you have difficulty
  - do not give your code to anyone

Distribution of Information

- **Information may be pass to the class through one of two media:**
  - An announcement in class,
  - Web page of the class,
  - An e-mail via an e-mail through UNR WebCampus

Summary

- **In this topic, we have:**
  - Outlined the course
  - Improving your performance
  - Discussed plagiarism and its consequences

Coming Up Next

- C++ Review
- Doxygen Documentation
- Data Abstraction

- Quiz 1 on Wednesday (from 5 pm until 11:59pm)

Out of the Box

- **Median of Two Sorted Arrays**

  https://leetcode.com/problems/median-of-two-sorted-arrays/description/

- **Plus One**

  https://leetcode.com/problems/plus-one/description/