Course Syllabus

Course Information
(course number, course title, term, any specific section title)

CS 1200 HON

Introduction to Computer Science

Fall 2016

Professor Contact Information
(Professor's name, phone number, email, office location, office hours, other information)

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Course Pre-requisites, Co-requisites, and/or Other Restrictions
(including required prior knowledge or skills)

None

Course Description

This course is intended to prepare honors students for the rigor and discipline required to succeed in our honors program. We will consider character traits that tend to lead to success and those that do not, preparedness and personal organization, getting ahead of the work load, and working in groups, what is defined as cheating and what is healthy collaboration, money matters and how to maintain discipline with finances and how to budget time. Ethical standards in the Engineering Profession, The ACM Guidelines, and Title IX at the University. The perils of missing classes, turning in assignments late or missing them altogether, failing exams and quizzes. The help that we provide to avoid all these perils through professors' and TAs' office hours and the Mentor Center.

We will also discuss opportunities for personal and professional growth through internships and REUs. We will expound the benefits of good nutrition and regular vigorous exercise, as well as discussing destructive habits, such as taking narcotics, tobacco smoking, vaping, and addiction to video games.

Students will study simple applications of Computer Science Theory, Statistics, Mathematics, and Physics. No programming will be required, although there will be multiple computer graphical simulations and tools that will demonstrate important topics, such as the problem of finite precision in numbers and in simulations of continuous systems where time is a real-valued variable that must be incremented. Aliasing in Computer Graphics (jaggies) will be studied and demonstrated. Students will be introduced to advanced problem solving techniques, such as dynamic programming, working entirely on paper. In statistics we will study errors bounds when measuring point statistics, confidence intervals on means, histograms and pdf charts and tables.

Overall students should be able to reason about science and scientific discovery and the digital world with a strong appreciation of the necessary concern for the precision and range of measurements being made.

Student Learning Objectives/Outcomes

Upon completion of this course, students will have:

. (a) An understanding of the engineering and computing professions and the degree programs leading to them.

. (b) An appreciation of professional ethics

. (c) An appreciation and practice of basic skills essential to success as a CS major including problem solving skills, communications skills, and team work.

. (d) An understanding of basic approaches to design and exposure to quantitative methods.

Required Textbooks and Materials

None

Suggested Course Materials

Notes on eLearning.

Assignments & Academic Calendar
(Topics, Reading Assignments, Due Dates, Exam Dates)

1. CS^2 Courses, 4-year honors course plan, electives, requirements for graduating with CS^2 honors

2. SWOT analysis

3. Dice: calculating sample means and variances, confidence intervals on means.

4. Disk Head Motion: use of a computer program to simulate a continuous world system that computes means and variances. Demonstration of the law of diminishing returns via Confidence Limits.

5. Ethics in Engineering: how is cheating defined at UT Dallas, in industry, in research? The ACM guidelines, interpersonal relationships in college and in the work place, sexual harassment, Title IX at UT Dallas.

6. Blocks： a simple exercise of arranging wooden blocks according to given requirements. This exercise encourages leadership and problem solving strategies, such as when to give up on a certain approach.

7. Straight edge and Compass problems – draw an equilateral triangle, a hexagon, a pentagon, an inscribed circle or a circumscribed circle for a given triangle, construct a Steiner Point for three given points, all using only a straight edge and a compass.

8. Fibonacci Numbers: the ubiquity of the Golden Ratio in nature, art, and architecture, its history, and the applications of Fibonacci numbers in Computer Science (worst case AVL tree height analysis). The problem of computing these numbers, whose magnitude grows so quickly.

9. Series: summation of common series found in probability theory, statistics, and computer science. (sum of i from 1 to N, sum of odd or even integers, sums of powers of i, etc., substitution, and telescoping.

10. Cannon Balls: How many cannon balls in pyramids of height H with square or triangular bases?

11. Brachistochrone: The famous problem posed to Newton by Jacques Bernoulli regarding the optimal path of a particle falling under gravity. We briefly study the mathematics used to derive the (non-linear) differential equation for the motion of the particle and then show that the upturned cycloid is a solution. An actual apparatus is used to demonstrate the superiority of the cycloid over a straight line. A Computer Simulation enables calculation of the flight time for those paths, plus the circular arc suggested by Galileo.

12. Bressenham: Optimal line drawing for straight line segments and circular arcs using Jack Bresenham's algorithms, Jaggies due to aliasing, and how to 'smudge' them away.

13. Finite Accuracy/Precision: By demonstrating that a computer simulation of a revolving cube gradually degrades due to accumulating arithmetic errors in the floating point number representation, students are readily able to experience problems with finite arithmetic precision.

14. Digits of Pi: The history of our attempts to compute ever more digits of Pi got me at age 15 interested in computers. We follow some of the many algorithms for this problem, including the most recent Spigot Algorithms.

15. Combinations. We use mathematical combinations as a means to demonstrate dynamic programming techniques. Students are able to solve quite difficult problems by designing tabular techniques that they can execute on paper.

16. Fractals and Mandelbrot: This subject provides an enjoyable end to our studies where, at first, we demonstrate fractals produced by recursive algorithms (production systems). Then the Mandelbrot Set enables us to glimpse infinity by zooming into the fractal for a few minutes and noting the similarities of the wart structures as they reappear. We study the basic math of the Mandelbrot and Julia Set, fixed points and finite orbits, etc.

Grading Policy
(including percentages for assignments, grade scale, etc.)

There will be approximately six home works and two projects. There may be a couple of quizzes, but no formal exams. Final grades will be determined by grades in home works (40%) and projects (60%).

Course & Instructor Policies
(make-up exams, extra credit, late work, special assignments, class attendance, classroom citizenship, etc.)

Makeup exams will only be offered in case of documented illness or other acceptable reason for absence. Prior notification is required when possible.

Comet Creed
This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

"As a Comet, I pledge honesty, integrity, and service in all that I do."

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus.

Please go to http://go.utdallas.edu/syllabus-policies for these policies.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.