REGIS UNIVERSITY

COLLEGE OF COMPUTER & INFORMATION SCIENCES

Course Syllabus

Course Number: CS 202
Course Title: Computational Foundations

Course Description

CS 202. COMPUTATIONAL FOUNDATIONS (3). An entry-level course introducing the foundational concepts of computer science, as the study of algorithms and data structures with respect to their formal properties, linguistic realizations, hardware realizations, and applications

Prerequisite Courses

None

Course Overview

This course is designed around the following metaphor. Imagine a river, on one side of which there is a lot of information about computer circuits and how they do such things as add numbers, move data from one register to another, keep track of the various phases of a calculation, make distinctions between different types of data, and ultimately, display all of that "stuff" so that an average person can read it. On the other side of our metaphorical river we have algorithms, well-defined processes for sorting, searching, iterating, performing recursions, analyzing linguistic structures, detecting convergences … the list is virtually endless.

The first "third" of this course will concentrate on a selected but representative set of well-known algorithms. (Many introductory courses and related textbooks focus only on the algorithm side of the river.) The second "third" will concentrate on the "circuits" side of the river and include digital logic, how computers read, fetch and do simple arithmetic with simple circuits.

The final "third" of the course will be devoted to a "bridge" which, once built, will allow us to move freely from "side to side" with a close-to-full understanding of both sides as well as the bridge which links them to each other.

At the risk of yet another metaphor, this course is designed explicitly to avoid the "dashboard and floorboard" type of computer science education, and instead, get us "under the hood" … i.e. there will be no "black box" mysteries when we are finished. So, let's get started.

Course Outcomes

Upon completion of this course, students should be able to (in no particular order):

1. Develop proficiency with digital logic and digital systems by designing, at the gate-level, a simple CPU and ALU based upon the basic building blocks of registers, counters,

finite state machines, register transfer logic, and timing circuits, which executes a simple Hardware Description Language.

2. Describe the machine level representation of data including: the binary representation of integer and floating-point numbers, using both unsigned and signed twos complement representations, character data representations, and color image representations
3. Explain the organization of the classical von Neumann architecture and the fetch, decode, and execute instruction cycle and control unit.
4. Using pseudo-code traces, explain basic problem-solving algorithms for sorting (selection, bubble, quicksort, and topological sorting algorithms), shortest path (Dijkstra's algorithm), and transitive closure (Warshall's algorithm).
5. Use basic Big-O complexity analysis to examine algorithm performance including compare different algorithmic approaches to solving the same sorting problem.
6. Explain the basics differences among different algorithmic strategies including: brute force, divide and conquer, greedy, and dynamic programming.
7. Begin to explain how formal linguistic terms are used to represent programming languages including the representation of simple arithmetic expressions using regular expressions and context-free grammars.
8. Convert Nondeterministic Finite Automata to Deterministic Finite Automata for a simple arithmetic expression.
9. Describe the difference between syntax and semantics including representing the meaning of a syntactic simple arithmetic expression as an operational semantic assembly code that can be executed by the digital logic systems designed in this course.

Course Materials

Required Text:

No required textbook. All necessary material is located in the CS202 Online Course Content.

Technology Tools:

1. A PC-compatible computer system running a version of the Windows operating system, or a Mac and administrator rights to install new software.

http://www.regis.edu/Academics/Learning-Management-System/System-Requirements.aspx

Pre-Assignment:

Online Format: Sign on to WorldClass and become familiar with the course navigation of the Web Curriculum.

Course Assignments and Activities:

Week	Topics	Topic Readings*	Activities Assignments and Associated Points*
1	**Intro to pseudocode** **1:** Selection Sort, Recursion **2:** Bubble Sort & Quicksort	**Topic 1** **Topic 2**	Assignments Topic 1 ≈ 2.6% Assignments Topic 2 ≈ 2.6% Participation – 10% (for entire course)
2	**3**: Topological Sort **4**: Warshall's Algorithm (Transitive Closure)	**Topic 3** **Topic 4**	Assignments Topic 3 ≈ 2.6% Assignments Topic 4 ≈ 2.6% Participation
3	**5:** Dijkstra's Algorithm (Shortest Path) **6:** Binary World	**Topic 5** **Topic 6**	Assignments Topic 5 ≈ 2.6% Assignments Topic 6 ≈ 2.6% Participation **Exam 1** – 10%
4	**7:** Minimization & Multiplexor **8:** Binary Addition, Ripple-Carry Adder	**Topic 7** **Topic 8**	Assignments Topic 7 ≈ 2.6% Assignments Topic 8 ≈ 2.6% Participation
5	**9**: JK Flip Flops, clocks **10:** Circuit Schematics & RISC202-8	**Topic 9** **Topic 10**	Assignments Topic 9 ≈ 2.6% Assignments Topic 10 ≈ 2.6% Participation
6	**11:** Finite State Machine Design **12:** Syntax Tree	**Topic 11** **Topic 12**	Assignments Topic 11 ≈ 2.6% Assignments Topic 12 ≈ 2.6% Participation **Exam 2** – 10%
7	**13:** Regular Expressions **14:** Simple Arithmetic Expressions	**Topic 13** **Topic 14**	Assignments Topic 13 ≈ 2.6% Assignments Topic 14 ≈ 2.6% Participation **Exam 3** – 10%
8	**15:** Infix, Postfix Notation	**Topic 15**	Assignments Topic 15 ≈ 2.6% Participation **Final Exam** – 20%
		Total	**100%**

****Note to Classroom sections only:*** Exact dates for topics and assignments may differ from the above grid. Your faculty's syllabus, handed out the first night of class, will indicate any changes.

Summary of Assignments and Percentage Weight towards course grade

Assignment	Value (percent of overall course grade)
Assignments 15 assignments (equally weighted)	40 %
Exams 1 – 3 (10% each)	30 %
Final Exam	20 %
Participation	10 %
Course Total	100 %

Late Assignment Policy for Assignments
Late assignments will be graded and then 2% will be deducted for each day the assignment is late, ***up to 5 days late***. Therefore, any assignment turned in more than ***5 days*** late will be given a grade of **zero**, and no feedback will be given.

Exams
There will be three exams and a final exam. Exam questions will be cumulative, taken from reading course content and assignments. Exams will **not** be accepted late.

Participation
Class participation/effort is important because we can all learn from each other. Your participation points can make a difference in the final grade. Participation means:

1. a. Present in class every session (classroom)
   b. Present in the forum every week (online)
2. a. Effectively responds to questions from the facilitator (classroom)
   b. Regularly checks forum and posts all required items by the deadlines (online)
3. Interacts/replies to other students in classroom/forum discussions.

Online Sections: See Faculty Syllabus for Online Weekly Discussion points distribution

Course Policies and Procedures

Adding this course during the Drop/Add Period

If you add this course during the drop/add period, you are responsible for ***immediately*** notifying the instructor that you joined the course late. None of the course due dates will be extended for you. If a due date has already passed when you add the course, late points will be deducted.

Repeating the course

If you are repeating this course (due to a previous withdraw or low grade), you are responsible for ***immediately*** notifying the instructor. If any of the course assignments have not changed since last time you took the course, you may be required to complete alternate assignments.

Plagiarism

Plagiarism includes submitting code obtained from any other person, publication, or any internet web source. ***All work submitted in CS202 must be your own.***

In cases of suspected cheating or plagiarism, the instructor will discuss the matter with the student(s) involved. The instructor reserves the right to question any student orally or in writing about any assignment, and to use the evaluation of the student's understanding of the assignment and of the submitted solution as evidence of cheating. All cheating incidents will be reported to the Computer Science department, and may also be reported to the Academic Integrity Board for further action.

CC&IS Grading Scale

Letter Grade	Percentage	Grade Point
A	93 to 100	4.00
A–	90 to less than 93	3.67
B+	87 to less than 90	3.33
B	83 to less than 87	3.00
B–	80 to less than 83	2.67
C+	77 to less than 80	2.33
C	73 to less than 77	2.00
C–	70 to less than 73	1.67
D+	67 to less than 70	1.33
D	63 to less than 67	1.00
D-	60 to less than 63	.67
F	Less than 60	0

Additional information about grading can be found in the latest edition of the University Catalog, available at http://www.regis.edu/Academics/Course%20Catalog.aspx.

CC&IS Policies and Procedures

Each of the following CC&IS Policies & Procedures is incorporated here by reference. Students are expected to review this information each term, and agree to the policies and procedures as identified here and specified in the latest edition of the University Catalog, available at http://www.regis.edu/Academics/Course%20Catalog.aspx or at the link provided.

- The CC&IS Academic Integrity Policy.
- The Student Honor Code and Student Standards of Conduct.
- Incomplete Grade Policy, Pass / No Pass Grades, Grade Reports.
- The Information Privacy policy and FERPA. For more information regarding FERPA, visit the U.S. Department of Education.

- The HIPPA policies for protected health information. The complete Regis University HIPAA Privacy & Security policy can be found here: http://www.regis.edu/About-Regis-University/University-Offices-and-Services/Auxiliary-Business/HIPAA.aspx.
- The Human Subjects Institutional Review Board (IRB) procedures. More information about the IRB and its processes can be found here: http://regis.edu/Academics/Academic-Grants/Proposals/Regis-Information/IRB.aspx.

The CC&IS Policies & Procedures Syllabus Addendum summarizes additional important policies including, Diversity, Equal Access, Disability Services, and Attendance & Participation that apply to every course offered by the College of Computer & Information Sciences at Regis University.

A copy of the CC&IS Policies & Procedures Syllabus Addendum can be found here: https://in2.regis.edu/sites/ccis/policies/Repository/CCIS%20Syllabus%20Addendum.docx.