CIS 205 – Discrete Mathematics I
Course Syllabus and Calendar – Fall 2012

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Brigham Young University–Hawai'i

Contents

1 Overview

Programming is the art of building up those simple things that computers can do into those fun but complicated things we want them to do.

Part of this involves certain "tricks of the trade," so to speak. Much as the human body has to fire certain nerve cells in order to make an arm pick up a pencil, the computer has to carry out certain primitive instructions to make the desired result happen.

The linkage between nerves firing and arms moving may not always be obvious.

The good news is that those "tricks of the trade" are kind of fun to learn and use. The scary part is they were discovered and developed by mathematicians originally, so they are considered to be a branch of Mathematics. But really, they belong to Computer Scientists. Like us.

Discrete Mathematics 1 introduces many of the un-

derlying mathematical principles used by computer scientists. While the usefulness may not always be immediately apparent, these concepts will be integral to our understanding of the principles of computing. Where possible, we will discuss the immediate application.

Although the word Mathematics is in the course title, this is basically a computer science course. Mathematical concepts are the focus of study, but they are reinforced through several programming projects and exams. Other activities may also be assigned to support those concepts that are not otherwise adequately reinforced or measured.

http://byuh.doncolton.com/cis205/2125/sguide.pdf is my study guide for this course.

1.1 So, What is Discrete Math?

Discrete means chunks, as opposed to Calculus, which is continuous.

With discrete, we are dealing with things like the natural numbers: 1, 2, 3, 4, 5, and so on. We are not dealing with things like $\pi = 3.1415...$ and $e = 2.71828...$ and natural logrithms.

So, it's whole things. Things that are either totally present or totally absent. Ones and zeros. True and false. Six sides on dice. Two sides on coins. Branches in trees. Nodes and edges in graphs.

Like I said, it's kind of fun.

1.2 Preparation

We assume you passed CIS 101 with a grade of C or better, or that you have other programming background in one of the languages we allow for this class.

1.3 There May Be Changes

Like all courses I teach, I will be looking for ways this one could be improved. Changes generally take the form of opportunities for extra credit, so nobody gets hurt and some people may be helped. If I make a change to the course and it seems unfair to you, let me know and I will try to correct it. If you are brave enough, you are welcome to suggest specific ways the class could be improved.

This particular course, CIS 205, is one I have not taught in several years, and I am trying a new approach to it. Therefore, the number of changes may be larger than normal for me.

2 Course Details

2.1 About the Course

- **Course Number:** CIS 205
- **Title:** Discrete Mathematics I
- **Course Description:** Functions, relations, and sets; basic logic; proof techniques; basics of counting. (Prerequisites: CIS 101).
- **Textbook (Rental):** Mathematical Structures for Computer Science (6th Edition), by Judith L. Gersting. ISBN 071676864X.
- **Classroom:** GCB 111
- **Start/End:** Sep 10 to Dec 12, 2012
- **Class Time:** MWF 8:40 to 9:40 AM
- **Final Exam:** Wed, Dec 12, 7:00 to 9:50 AM

2.2 Important Website Links

- **Don Colton Home Page (General):** http://doncolton.com/
- **Prof Colton Home Page (BYUH):** http://byuh.doncolton.com/
- **CIS 205 Course Home Page:** http://byuh.doncolton.com/cis205/
- **CIS 205 Study Guide:** PDF http://byuh.doncolton.com/cis205/2125/sguide.pdf
- **My Learning Management System:** (Grade Book, Exams, etc.) https://dcquiz.byuh.edu/

2.3 About the Instructor

- **Instructor (me):** Don Colton
- **My email:** doncolton2@gmail.com
- **My Office:** GCB 128
- **Office Hour:** MWF 10:50–11:20 AM
- **Office Hour:** MWF 1:10–1:40 PM

I may digitally record the audio of my lectures some days. This helps me improve my teaching materials.

3   Learning Objectives

The following is a statement of the high-level learning objectives for this course. Each objective can be further divided into many smaller objectives.

By the conclusion of this course, students will:

* demonstrate the ability to understand and apply knowledge appropriate for Computer Science.

* understand and be able to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.

Students will demonstrate most of these skills by creating in timed and supervised situations short programs that perform specific tasks.

4   Grading

Grading is on a standard 60/70/80/90 model using 1000 points. You earn points for effort (400) and skill (600), with some extra credit possible.

Grading is based on 1000 points

930+	A	900–929	A–	870–899	B+
830–869	B	800–829	B–	770–799	C+
730–769	C	700–729	C–	670–699	D+
630–669	D	600–629	D–	0–599	F

https://dcquiz.byuh.edu/ is where I track your progress online. It is my personal Learning Management System. There I maintain my online grade books. You can see how your points are adding up. You can compare your points with those of other students in the class (without seeing any names).

For this class, there are two grade books: Effort, and Overall. The Effort grade book tracks your Effort points. The Overall grade book combines Effort and Skill to track your final grade.

4.1   My Theory of Effort

About a third of your grade is based on how much time you spend studying, whether you learn a lot or nothing. (Of course, we hope you learn a lot.)

My effort approach is modeled after the Sabbath. God does not tell us what to do, besides attend church. But he does claim one day a week. We each have to decide how best to use it.

Similarly I will not tell you what to do. I just say how long you must do it. You are free to read chapter 1 fifty times, either lightly or deeply. You can start at the table of contents and look for things that interest you. You can spend your whole time programming the extra credit assignments. Whatever you want. Just put in the time following the rules below. I will be happy and you will be smart. That's the theory.

I hope you will look at the course calendar and devote your study time to things that will be relevant in the near future. But it is up to you.

4.2   Effort: (64+10) Daily Update

Class each day starts with the "daily update." It is my way of taking roll, and your way of saying something to the other students and to me. It must be taken during the 15-minute window of time that starts 10 minutes before class and ends 5 minutes into class.

This is worth two points per class period, with 64 points expected (for 32 class periods) and 74 points maximum (for all 37 class periods this semester). It is partly a reward for coming on time, or close enough that you can do the update.

It also provides an easy way for you to report your study points.

4.3   Effort: (336+84) Study Points

By (336+84) we mean there are 336 points of regular credit and 84 points of extra credit in this category.

We award three points per hour of "study." By study we mean you are engaging with the materials of this course. We expect you to put in a total of about 100 hours of study on this course, with about 40 of those hours being right in class and about 60 of those hours being outside of class.

During Fall, a typical week works out to 3 hours of study in class, and 5 to 7 hours out of class, for a total of 8 to 10 hours of study per week. I expect 8. I give you credit for up to 10.

Using 8 hours per week for 14 weeks, that works out to 336 points in this category, or a little more than 1/3 of your total points. You may earn up to 84 additional points (extra credit) in this category during the semester for a maximum of 420 points.

(336) max 420, Time Spent Studying
- 24 max 30, in the week before class on Sep 17
- 24 max 30, in the week before class on Sep 24
- 24 max 30, in the week before class on Oct 1
- 24 max 30, in the week before class on Oct 8
- 24 max 30, in the week before class on Oct 15
- 24 max 30, in the week before class on Oct 22
- 24 max 30, in the week before class on Oct 29
- 24 max 30, in the week before class on Nov 5
- 24 max 30, in the week before class on Nov 12
- 24 max 30, in the week before class on Nov 19
- 24 max 30, in the week before class on Nov 26
- 24 max 30, in the week before class on Dec 3
- 24 max 30, in the week before class on Dec 10
- 24 max 30, in the week of the Final on Dec 14

Reporting Your Study Time

As part of the Daily Update, each day I will ask you how much time you spent studying. I will use your report to update your study score. If you do not report in some other way, you can report by sending an email to me.

Normally each Wednesday you should report having studied about three hours in the previous two days. Each Friday you should report having studied about six hours in the previous four days. Each Monday you should report having studied about nine hours in the previous seven days.

I will take the hours you report. I will multiply that by 3.

To get the study points, you must keep a written, contemporaneous (up to date), daily record of the time you studied for this course.

You must earn the points in the week for which they are awarded.

Study time is measured from the scheduled start of the first class each week.

Carry-overs are not allowed unless I give you special permission. This can happen if you have a special circumstance like illness or university-approved travel. Check with me.

We only count time you gave your mostly undivided attention to this course. (Minor interruptions are

okay. Big ones stop the clock.)

1. You can count time you attended class (and paid attention; sleeping does not count).

2. You can count time you read / studied any part of the text book, even if it is beyond the material we plan to cover this semester. (CIS 206 uses the same book.)

3. You can count time you read / studied any part of the readings I provide, including this syllabus, the study guide, and the course web page. This includes following the links in the study guide, which typically lead to Wikipedia pages, and reading what you find there. It also includes following links on the course web page and reading what you find there.

4. You can count time you spent programming the GBot labs mentioned below, including the extra-credit labs.

5. You can count time you spent for this class reviewing and practicing exams.

6. You can count time you studied for this class with other students.

7. You can count time you worked for this class with tutors.

If you think of another category that you think should count, ask me.

In short, even the very smartest student should find something productive and entertaining to fill up the study time. (Some of the advanced programming labs are really fun.)

4.4   Effort Summary (400+94)

- Effort:
  - Daily Update: 64+10
  - Study Points: 336+84
- Total: 400+94

If you have earned enough points that full credit on all future Effort items would get your overall grade up to an A, and you bring it to my attention, then I will grant those remaining effort points and you will have your A.

4.5   Skill: (180+160) GBot Lite

During the semester we will do, mostly in class, a number of computer programs. Supported lan-

guaged include Perl, which is taught in the CIS 101 class, and several alternatives.

http://gbot.dc.is2.byuh.edu/ has more.

GradeBot Lite (or GBot for short) will accept your program and test it. When it finds an error, it will inform you so you can fix it. When it runs all its tests without finding any errors, it will inform you so you can turn it in to me.

Regular Credit (180 pts): The tasks 205.p01 through 205.p15 will be assigned to everyone. These will be done in class with my assistance. There are nine tasks worth 20 points each.

Extra Credit (160 pts): The tasks 205.p21 and higher, listed on the GBot website, are available for extra credit in this class, details to be determined. These will be done on your own, outside of class. There are (currently) eight tasks worth 20 points each.

Note that time you spend working on these programs also counts a study time.

GBot Lite: How To Submit

When you have a program working, email it to me. You can work ahead. You do not need to wait until it is due.

My email address is doncolton2@gmail.com

In the subject line of your email,
• Mention CIS 205.
• Mention which program, by number, like p01.

In the body of your email,
• Tell me your name unless it is obvious from your email address.
• Specify which compiler should be used.
• Include the text of your program.

Do not use attachments. Do not use "rich text." Just use plain text.

GBot Lite: Helping Others

You can help other students complete the GBot labs.

Do NOT give them a copy of your code. Let them do their own work.

I am okay with you letting somebody look at your program, on your computer. You can talk about it and how it works. But don't let them just copy it. They need to understand their work.

I am also okay with you looking at their program and pointing out ways it could be improved. But please let them do their own work.

4.6   Skill: (420+0) DCQuiz Exams

During the semester we will do in class, a number of "skills" exams that test your skill with certain concepts and procedures. Each exam will be practiced twice and then given once for credit. At the end of the semester, each exam will be given again to let you try to improve your grade.

• S1 q41 Res: Propositional Calculus Resolution
• S2 q13 BO: Big Oh Analysis of Algorithms
• S3 q31 Ct: Counting Comb, Permutations
• S4 q45 CP: Conditional Probability
• S5 q36 BST: Binary Search Tree
• S6 q35 Huf: Huffman Coding
• S7 q18 MST: Minimum Spanning Tree

4.7   Points Summary (1000+254)

• Effort:
  ◦ Study Points: 336+84
  ◦ Daily Update: 64+10
  ◦ Effort Total: 400+94
• Performance:
  ◦ GBot Programs: 180+160
  ◦ Skill Tests: 420+0
  ◦ Performance Total: 600+160
• Total: 1000+254

4.8   Other Extra Credit

Report an error in the materials I provide. I always provide a syllabus and a course website. I may provide other materials, such as a textbook, a study guide, and sample tests. Each error reported can earn you extra credit.

5   Calender

Each class starts with a quick daily update (five minutes) and an opening prayer. After that, we spend

time looking at your comments and discussing them. Then we launch into the material I have prepared for the day. Hopefully the material is an in-class activity, but it might be a lecture. The calendar lists my plans as they currently stand, but I know I will have to make changes and improvements as we go along.

5.1   Day By Day

This calendar is intended to tell you what to study, and when to expect exams.

However, this is the first time I have taught this class in several years, and my format is different than the last time I taught it, so I think the calendar will receive lots of small changes as we go along.

Mon Sep	10	37 grading, study time, text books
Wed Sep	12	36 p01.factors
Fri Sep	14	35 p02.fib: Fibonacci Numbers
Mon Sep	17	34 p02.fib: Fib; Stack, Static
Wed Sep	19	33 G1.1 Formal Logic, G1.2 Prop
Fri Sep	21	32 s1 q41 Prop Calc Res (prac)
Mon Sep	24	31 s1 q41 Prop Calc Res (prac)
Wed Sep	26	30 p03.perf, s1 q41 Prop Calc (prac)
Fri Sep	28	29 s1 q41 Prop Calc Res (exam)
Mon Oct	1	28 G2.1 Proofs, s2 Big Oh (prac)
Wed Oct	3	27 G2.2 Induction
Fri Oct	5	26 G2.4 Recursive Defs, p04.gcd
Mon Oct	8	25 G2.6 Anl Alg, s2 Big Oh (prac)
Wed Oct	10	24 p05.pfac, s2 Big Oh (prac)
Fri Oct	12	23 s2 Big Oh (exam)
Mon Oct	15	22 G3.1 Sets
Wed Oct	17	21 G3.2 Count, s3 q31 Perm (prac)
Fri Oct	19	20 p11.mult, s3 q31 Perm (prac)
Mon Oct	22	19 s3 q31 Count Comb Perm (exam)
Wed Oct	24	18 G3.3 Pigeonhole, p13.oswor
Fri Oct	26	17 G3.4 Permutations, p14.choose
Mon Oct	29	16 G3.5 Prob, s4 q45 C Prob (prac)
Wed Oct	31	ISECON, No Class
Fri Nov	2	ISECON, No Class
Mon Nov	5	15 p15.owii, s4 q45 C Prob (prac)
Wed Nov	7	14 s4 q45 Conditional Prob (exam)
Fri Nov	9	13 G4.1 Relations
Mon Nov	12	12 G5.1 Graphs, G5.2 Trees
Wed Nov	14	11 s5 q36 Binary Search Tree (prac)
Fri Nov	16	10 s5 q36 Binary Search Tree (prac)
Mon Nov	19	09 s5 q36 Binary Search Tree (exm)
Wed Nov	21	08 G5.4 Huffman
Fri Nov	23	Thanksgiving Holiday, No Class
Mon Nov	26	07 s6 q35 Huffman Coding (prac)
Wed Nov	28	06 s6 q35 Huffman Coding (prac)
Fri Nov	30	05 s6 q35 Huffman Coding (exam)
Mon Dec	3	04 G6.2 Euler Path, Hamiltonian
Wed Dec	5	03 G6.3 MST, s7 q18 MST (prac)
Fri Dec	7	02 s7 q18 Min Spanning Tree (prac)
Mon Dec	10	01 s7 q18 Min Spanning Tree (exm)
Wed Dec	12	00 Final Exam (3h) 7:00–9:50 AM

5.2   Excused Absences

My policy on absences is to build enough slack into the schedule that you can miss a day whenever you need to. Take a friend to the airport? Take your spouse or child to the doctor? Take a field trip for another class? No problem.

Time away from class can be made up by other forms of studying. You do not need to be in class to collect those points.

Daily Update points assume that you will be on time for class about 3/4 of the time. If you are on time more than that, you get extra credit. If less, you can make up for it in some other way.

Every exam is given at least twice and I keep your highest score, so if you have to miss an exam, my advice is to study harder for when I offer it again. If you miss all the times I give a certain exam, you can make it up during the final exam time.

The scheduled final exam consists of an opportunity to retake **any** exam that was offered during the semester. If you are happy enough with your previous scores, **you can skip the final.**

Because the final is just a retake, if you want to take the final but you have to miss it, **normally** I just say no, or I require you to take an Incomplete in the class and make it up the next time I teach the class.

Rare: There is always an exception. It might be you. If you have a situation that does not fit inside these guidelines, come and see me as soon as you know about it. If we plan ahead, it reduces the difficulties.

6 Support: Tutoring, etc.

6.1 Tutoring

The CIS department provides tutoring in GCB 111, Monday through Friday, typically starting around 5 PM and ending around 11 PM (but earlier on Fridays). Normally a schedule is posted on one of the doors of GCB 111.

Tutors can be identified by the red vests they wear when they are on duty.

The best way to use a tutor is to show them something that you have done and ask them why it does not work the way you want. This can open the door to a helpful conversation.

Another good way to use a tutor is to show them something in the textbook and ask a question about it.

The worst way to use a tutor is to plunk down next to them and say, "I don't understand. Can you teach me?" If you did not try hard to read carefully, you are wasting everybody's time.

If you still need help, please come and see me, even outside my posted office hours. My door is always open.

6.2 Study Groups

You are encouraged to form a study group. If you are smart, being in a study group will give you the opportunity to assist others. By assisting others you will be exposed to ideas and approaches (and errors) that you might never have considered on your own. You will benefit.

If you are struggling, being in a study group will give you the opportunity to ask questions from someone that remembers what it is like to be totally new at this subject. They are more likely to understand your questions because they sat through the same classes you did, took the same tests as you did, and probably thought about the same questions that you did.

7 BYUH Learning Framework

I believe in the BYUH Framework for Learning. If we follow it, class will be better for everyone.

7.1 Prepare for CIS 205

Prepare: Before class, study the course material and develop a solid understanding of it. Try to construct an understanding of the big picture and how each of the ideas and concepts relate to each other. Where appropriate use study groups to improve your and others' understanding of the material.

In CIS 205: Make reading part of your study. There is more than we could cover in class because we all learn at different rates. Our in-class time is better spent doing activities and answering your questions than listening to me lecture.

7.2 Engage in CIS 205

Engage: When attending class actively participate in discussions and ask questions. Test your ideas out with others and be open to their ideas and insights as well. As you leave class ask yourself, "Was class better because I was there today?"

In CIS 205: Participate in the in-class activities. Those that finish first are often requested to help those that want assistance. It is amazing what you can learn by trying to help someone else.

7.3 Improve at CIS 205

Improve: Reflect on learning experiences and allow them to shape you into a more complete person: be willing to change your position or perspective on a certain subject. Take new risks and seek further opportunities to learn.

In CIS 205: After each exam, with possible rare exceptions, I allow you to see every score and every comment and every answer submitted for every question. Review your answers and those of other students. See how your answers could be improved. If you feel lost, study the readings again.

8   Standard Statements

All syllabi are encouraged or required to address certain topics. These are generally considered to be common sense, but we find that it is useful to mention them explicitly anyway.

8.1   Dress and Grooming Standards

The dress and grooming of both men and women should always be modest, neat and clean, consistent with the dignity adherent to representing The Church of Jesus Christ of Latter-day Saints and any of its institutions of higher learning. Modesty and cleanliness are important values that reflect personal dignity and integrity, through which students, staff, and faculty represent the principles and standards of the Church. Members of the BYUH community commit themselves to observe these standards, which reflect the direction given by the Board of Trustees and the Church publication, "For the Strength of Youth." The Dress and Grooming Standards are as follows:

Men. A clean and neat appearance should be maintained. Shorts must cover the knee. Hair should be clean and neat, avoiding extreme styles or colors, and trimmed above the collar leaving the ear uncovered. Sideburns should not extend below the earlobe. If worn, moustaches should be neatly trimmed and may not extend beyond or below the corners of mouth. Men are expected to be clean shaven and beards are not acceptable. (If you have an exception, notify the instructor.) Earrings and other body piercing are not acceptable. For safety, footwear must be worn in all public places.

Women. A modest, clean and neat appearance should be maintained. Clothing is inappropriate when it is sleeveless, strapless, backless, or revealing, has slits above the knee, or is form fitting. Dresses, skirts, and shorts must cover the knee. Hairstyles should be clean and neat, avoiding extremes in styles and color. Excessive ear piercing and all other body piercing are not appropriate. For safety, footwear must be worn in all public places.

8.2   Accommodating Special Needs

Brigham Young University–Hawai'i is committed to providing a working and learning atmosphere which reasonably accommodates qualified persons with disabilities. If you have any disability that may impair your ability to complete this course successfully, you are invited to contact the Students With Special Needs Coordinator at 808-675-3518. Reasonable academic accommodations are made for all students who have qualified documented disabilities.

8.3   Plagiarism

http://en.wikipedia.org/wiki/Plagiarism has a wonderful article on plagiarism. Read it if you are not familiar with the term. Essentially, plagiarism is when you present the intellectual work of other people as though it were your own. This may happen by cut-and-paste from a website, or by group work on homework. In some cases, plagiarism may also create a violation of copyright law. If you borrow wording from someone else, identify the source.

Intentional plagiarism is a form of intellectual theft that violates widely recognized principles of academic integrity as well as the Honor Code. Such plagiarism may subject the student to appropriate disciplinary action administered through the university Honor Code Office, in addition to academic sanctions that may be applied by an instructor.

Inadvertent plagiarism, whereas not in violation of the Honor Code, is nevertheless a form of intellectual carelessness that is unacceptable in the academic community. Plagiarism of any kind is completely contrary to the established practices of higher education, where all members of the university are expected to acknowledge the original intellectual work of others that is included in one's own work.

CIS 205: In this course group discussion of labs is permitted and encouraged but you are not allowed to turn in work that is beyond your understanding, whether you give proper attribution or not. Make sure you understand what you are submitting and why each line is there.

CIS 205: On exams you are required to work from personal memory, using only the resources that are normally present on your computer. This means the exams are closed book and closed notes. Students caught cheating on an exam may receive a grade of F for the semester, no matter how many points they may have earned, and they will be re-

ported to the Honor Code office.

Faculty are responsible to establish and communicate to students their expectations of behavior with respect to academic honesty and student conduct in the course. Observations and reports of academic dishonesty shall be investigated by the instructor, who will determine and take appropriate action, and report to the Honor Code Office the final disposition of any incident of academic dishonesty by completing an Academic Dishonesty Student Violation Report. If the incident of academic dishonesty involves the violation of a public law, e.g., breaking and entering into an office or stealing an examination, the act should also be reported to University Police. If an affected student disagrees with the determination or action and is unable to resolve the matter to the mutual satisfaction of the student and the instructor, the student may have the matter reviewed through the university's grievance process.

8.4   Sexual Harassment

BYUH's policy against sexual harassment complies with federal Title IX of the Education Amendments of 1972 to protect university students from student-to-student sexual harassment both in and out of the classroom setting. Any incidents of such student-to-student harassment should be reported to either the Director of Human Resources (808-675-3713) or the Honor Code Office (808-675-3531). Allegations of sexual harassment are taken seriously. Upon receiving a report of sexual harassment, the Director of Human Resources will take appropriate action to resolve and correct conditions resulting from individual perceptions or from inappropriate behavior.