CMP 112: Computational Thinking  4 Credits

Instructor: Steve Lange  Email: slange@carrollu.edu
Office: MacAllister 208  Phone: (262) 951 - 3179
Office Hours: Mon/Wed  9:00 am – 11:00 am;  Fri  10:00 am – 11:00 am
Or by appointment

Class Meets:
Section A: Tues/Thurs  8:00am-9:50am  Main 101
Section B: Tues/Thurs  10:00am-11:50am  Main 101
Section C: Mon/Wed/Fri  12:00pm-1:10pm  Main 101

Prerequisites: College Algebra (MAT 101) or placement recommendation

Textbook:

- *OpenIntro Statistics*, Ed 3, (Diez, Barr, and Cetinkaya-Rundel) Required
- *How to Think Like a Computer Scientist: Learning with Python* (Downey, Elkner, Meyers)
  [http://faculty.carrollu.edu/djohnson/Python](http://faculty.carrollu.edu/djohnson/Python)
- Both Available on-line via URL at E-Learning site

OPTIONAL: *Excel Statistics* (Salkind), Sage Publishers  ©2015

Grading:

- Homework & Quizzes (45%), Participation (5%), Midterm (20%), Final Exam (30%)

Grade Scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>A</th>
<th>AB</th>
<th>B</th>
<th>BC</th>
<th>C</th>
<th>D</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>[92-100]</td>
<td>[88-92]</td>
<td>[82-88]</td>
<td>[78-82]</td>
<td>[70-78]</td>
<td>[60-70]</td>
<td>[0-60]</td>
</tr>
</tbody>
</table>

Final Exam:

- Section A: Wed. Dec. 20th  8:00 am - 10:00am
- Section B: Mon. Dec. 18th  8:00 am - 10:00am
- Section C: Wed. Dec. 20th  11:00 am - 1:00pm

Course Overview:
The purpose of this course is to introduce students to mathematical and computational techniques useful in the health, natural, and social sciences. The focus will be on basic statistics and computer interaction, both graphical and textual. Students will gain a basis for developing strong 21st Century job skills.

Course Objectives:
This course intends to introduce students to:
1. Some essential elements of computational thinking
2. Basic statistical analysis concepts
3. Essential computer literacy skills

Learning Outcomes: (assessment will be via homework, quizzes, midterm, and final)
By the end of this course, students should be able to:
- Use a computer to solve uni/multivariate equations. (Obj 1, 3)
- Use a computer to optimize uni/multivariate functions. (Obj 1, 3)
- Make the connection between real-world processes and their corresponding mathematical models. (Obj 2)
- Analyze data using both linear and non-linear regression models. (Obj 1-3)
- Design and use probabilistic models to simulate stochastic processes. (Obj 1-3)
- Create and interpret appropriate visualizations of data sets. (Obj 1-3)
- Analyze data sets using descriptive statistics and basic inferential statistics. (Obj 2)
- Communicate with a computer using both graphical and text interfaces. (Obj 1, 3)
Course Policies:

**Academic Integrity**: The Carroll College Academic Integrity Policy is located in your student handbook. Please familiarize yourself with it. If you violate this policy in any way, I reserve the right to impose a sanction up to failure on the assignment/assessment or failure in the course. Note: this means the sanction could be anything from a meeting with the instructor up to and including failing the course. In addition, violations will be submitted to the Student/Faculty Ethics Committee. If you have a history of violations, this may result in further sanctions.

**Attendance**: It is expected that you attend every lecture. The textbooks cover much, but not all of the course material. Other reading material will be made available through handouts or web links, and some material will only be available in as part of class discussion. You will be accountable for all material covered in the class with no exceptions. Some of the homework grade may be determined by in-class projects and quizzes. Unexcused absences may result in zeros for those assignments. **Instructor will not repeat lecture material. If you miss a class you are responsible for obtaining information covered.** Also, send the instructor an email informing them of your absence.

**Homework/Assignments**: Assignments are an aid to learning the material. You are allowed to work on them in groups, using any-and-all resources at your disposal. They are **due at the START** of class; this means completed, printed and stapled prior to the class start time. If you are printing at the class start time, your work is considered late. No late homework will be accepted and will result in forfeiture of credit for that assignment. Should an unfortunate situation arise, contact the instructor prior to the due date/time for possible consideration of other arrangements. Some of the homework may involve in-class exercises. To earn a good grade for these, you will need to 1) Attend class, 2) Participate fully in the exercises, and 3) Ask questions as needed.

**Assistance**: This course is now covered by the Learning Common. Contact the center for the available hours. As always, your instructor is your first stop for requesting assistance!

**Tests**: There will be one midterm test and a final exam. Each test should be considered cumulative. However, each test will focus more on recently covered material. Tests will include questions concerning concepts as well as practical application of skills. **THERE WILL BE NO MAKEUPS FOR TESTS!**

**Accommodation for Disabilities**: If you need accommodations for a documented disability, or are considering obtaining documentation, you should make an appointment with Martha Bledsoe, our disabilities coordinator, no later than the first week of class. She can be reached by calling 262-524-7335 or contacting her via e-mail at wyc@carrollu.edu. It is your responsibility to get any paperwork turned in to your instructor as soon as possible so that they are able to make the required accommodations.

**Carroll Portal (Canvas)**: This class will use the Carroll Portal for various purposes. Homework descriptions and data files will be posted there as needed. Your grades will be posted there when available. Please keep track of your grades yourself as well, and if you notice any errors, please let your instructor know as soon as possible.

**Computer Policy**: This class is being held in a computer classroom. It is expected that all computer use be class-related. Chat programs, email, games, social media interaction, and unrelated browsing are not to be used during class. Student screens can be seen from the main terminal, and students observed breaking this rule will be asked to leave and marked absent for the day. Note that cellphones, and mobile devices are all small computers, so this rule applies to them as well.

**Modifications to the syllabus** - The instructor and the university reserve the right to modify, amend or change the syllabus (schedule, course requirements, grading policies, etc) as the curriculum and/or program require(s).
Submitting Assignment Requirements

A. Staples
Always have your papers stapled, at an angle, in the upper left corner, as close to the corner as possible. NOTE: the electronic staplers often staple deep into page. Avoid this staple positioning. It is difficult to review work on subsequent pages. Be sure your papers are printed and stapled “prior” to class start.

B. Printing
By default, assignments should be printed back-to-back (both sides of the paper). If your printer does not print on both sides of the paper, that is OK! You do not need to contact the instructor to ask if it is OK to print on one side. Assignments that say, “Print on both sides” will not lose points if they are printed on one side only.

There are “some” (not many) assignments that require you to print on “ONE” side only. This “is” a requirement and will be clearly defined in the instructions. Failure to do so will result in loss of points.

C. Excel worksheets.
Excel assignments that are printed landscape, must use the following instructions for inserting into the packet.

1. Turn worksheet 90 degrees counter clockwise. This will result in the top of the worksheet being on your left.
2. Keeping that rotation, insert sheet into required location of packet.
3. If you are only submitting landscape excel sheets, again rotate as described and staple in the upper left.

Sample submissions:

Staple too deep in assignment

Correct Excel rotation and staple position
Week 1 (Sept. 4)  
Intro to Course & Stats; experiments and data

Week 2 (Sept. 11)  
Excel Basics: Order of Op’s; Cell Addressing; Control Printing, etc.  
Excel Cont.’d: Using functions and conditional formatting

Week 3 (Sept 18)  
Data Visualization Intro  
Data Visualization – using excel; loading data & making graphs

Week 4 (Sept. 25)  
Descriptive stats  
Python Intro: Environment and basic Input & Output

Week 5 (Oct. 2)  
Python: IF, IF-ELSE, IF-ELIF  
Python: Functions & Statistics

Week 6 (Oct 9)  
More Python: Decision Trees  
Mid-Term Exam

Oct 13 – Oct 17  
Mid-Term Break (Fri. 6pm – Tues)

Week 7 (Oct 16)  
(classes resume Wed. Oct. 18)  
Modeling: Linear model / linear regression;

Week 8 (Oct 23)  
Non-Linear Modeling  
correlation, R², extrapolation, Intro to Probability

Week 9 (Oct 30)  
Catch-up day ~or~ Additional practice (as needed)  
Z-scores and normal distribution; properties of the normal distribution;

Week 10 (Nov 6)  
Zscores using Excel  
Intro to Hypothesis testing & PValues

Week 11 (Nov 13)  
1-Sample T-Tests; Tscores; and interpreting the results – especially the p-value;  
Difference between a single test statistic (x) and a sample test statistic(\bar{x});

Week 12 (Nov 20)  
Matched pair T-Test  
Thanksgiving Break (Thur – Sun)

Week 13 (Nov 27)  
Two-Sample T-Tests  
Intro to ID’g different Tests

Week 14 (Dec 4)  
ID T-Tests continued & Solve using various T-Tests  
ANOVA, Using proportions and T-Testing; Central Limit Theorem; Review Excel, Python

Week 15 (Dec 11)  
Last Day of Class – Final Exam Part-1

Final Exam:  
Section A: Wed. Dec. 20th 8:00 am - 10:00am  
Section B: Mon. Dec. 18th 8:00 am - 10:00am  
Section C: Wed. Dec. 20th 11:00 am - 1:00pm