Computer Science Department
cs.salemstate.edu

SYLLABUS **Spring, 2016**

CSC 246 Information Visualization **4 cr. DII Q**
Prerequisites: One Mathematics course chosen from MAT 108, MAT 110, MAT 120, and MAT 208 and above; plus CSC 201J, or equivalent programming experience and permission of Department Chairperson.

Instructor: Beifang Yi **Office**: MH 211A **Phone**: (978) 542-7246
email: byi@salemstate.edu **Hours**: WR (12:00pm-2:00pm) **Web Site**: http://cs.salemstate.edu/~byi/
W(4:00-4:30pm, 8:00-8:80pm)

Section	Time	Room	Final Exam
01, S1	W 4:30pm—8:00pm	MH 206	**Wednesday, 5/4, 6:00pm—8:00pm , MH 206**

Catalog description:
This course presents the basic science and techniques behind information visualization, introducing fundamental concepts concerning the use of color, image processing, computer graphics, and scientific visualization. The course describes the principles of visual perception, information data types, and visual encoding of data representations, and then focuses on the study, design, and development of visualization techniques for the analysis, comprehension, explanation, exploration, and manipulation of large collections of datasets. The latest visual representation methodologies and state-of-the-art visualization tools including programming language(s) and visualization libraries and toolkits will be applied in the course to help understand the subject and to design and generate visual interpretation of large amounts of complex data collected from diverse areas such as physics, chemistry, biomedical studies, meteorology, geospatial research, business, etc. Students will form teams to participate in group projects that emphasize interdisciplinary interaction and cooperation, in order to analyze and solve real world quantitative problems. Four lecture hours per week, plus additional project time outside of class.
Prerequisites: One Mathematics course chosen from MAT 108, MAT 110, MAT 120, and MAT 208 and above; plus CSC 201J, or equivalent programming experience and permission of Department Chairperson.

Goals:
The purpose of this course is to introduce basic concepts of scientific visualization and to apply the latest visualization techniques in the real world problems encountered in science, engineering, and business. The goals of this course are:
CG01: to develop an appreciation for the latest development of information visualization;
CG02: to understand the concepts of analyzing, manipulating, and presenting complex data in an intuitive form;
CG03: to understand the visualization techniques of producing insightful visual contents;
CG04: to give students experience in collecting, analyzing, processing, interpreting, and presenting data;
CG05: to give students experience in applying visualization techniques and tools in real world quantitative problems.

Objectives:
Upon successful completion of the course, a student will have:
CO01: demonstrated basic knowledge of human visual perception, cognitive issues, and color vision;
CO02: demonstrated basic knowledge of computer graphics and image processing;
CO03: described characteristics of datasets and experienced with real data in a broad view of the rich world of information visualization;
CO04: demonstrated knowledge of and skills in collecting, analyzing, interpreting, and presenting data;
CO05: compared information visualization to scientific visualization;

CO06: described visualization methodologies and techniques used in the manipulation of complex data, i.e., in color encoding, encoding of values and relations, trees and networks, maps, higher-dimensional data, etc.
CO07: demonstrated basic knowledge of volume rendering and scalar, vector tensor visualizations;
CO08: applied visualization principles and techniques in projects (using visualization tools/API/library and/or one programming language) which are related with at least two different areas, for example, biomedical studies, geosciences, physics, chemistry, meteorology, business, … and etc.

Course Topics:

A detailed topics list and a general course bibliography can be found on the Computer Science Department website at http://cs.salemstate.edu/dept/index.php?page=184. Select CSC 246 to access a PDF document.

Text (Required):

- **Visualizing Data: Exploring and Explaining Data with the Processing Environment**, by Ben Fry, O'Reilly Media, 2008 (ISBN: 978-0-59-641455-6)
- **Learning Processing: a Beginner's Guide to Programming Images, Animation, and Interaction,** by Daniel Shiffman, Morgan Kaufmann, 2008 (ISBN: 978-0-12-373602-4).

Additional references:

- Course website: http://cs.salemstate.edu/~byi/CSC246_Info_Visual/index.html.
- http://www.learningprocessing.com/ (a website for one of the textbooks).
- http://processing.org/
- http://benfry.com/ (a website for Ben Fry who was one of the Processing creators)
- **Information Visualization: Perception for Design**, 3rd Edition, by Colin Ware, Morgan Kaufmann, 2013 (ISBN: 978-0-12-381464-7).
- **Visual Thinking: for Design (Morgan Kaufmann Series in Interactive Technologies)**, by Colin Ware, Morgan Kaufmann, 2008 (ISBN: 978-0-12-370896-0)
- **Visualizing Data: Exploring and Explaining Data with the Processing Environment**, by Ben Fry, O'Reilly Media, 2008 (ISBN: 978-0-59-641455-6)
- **Processing: a Programming Handbook for Visual Designers and Artists**, by Casey Reas and Ben Fry, The MIT Press, 2007 (ISBN: 978-0-26-218262-1)
- **Beginning Python Visualization: Crafting Visual Transformation Scripts (Books for Professionals by Professionals),** by Shai Vaingast, Apress, 2009 (ISBN: 978-1-43-021843-2)

Required Material:

(Required) Thumb (flash) drive, 4 GB minimum or online storage (for saving your projects)

Software and Programming Languages:

- Processing 2.2.1 or above—stable release (required)
- Python 2.6 or above
- R (programming language)
- Java, Javascript, HTML/CSS.

Cell phones:

Turn the ringer off, or, better yet, *turn the phone off*.

Lecture Attendance:

Class attendance is ***STRONGLY* recommended: there are a huge amount of topics to be covered in the class and their implementation with the use of new programming languages and toolkits to be practiced in the class (given the fact that there are no separate lab offerings to the classes).** Lecture will start promptly at the scheduled time. While class attendance does not *directly* affect your final grade, some of the material covered in class is not found (in the same form) in the text, so class attendance and notes are very important. Note that you are at all times responsible for materials and assignments discussed in class: if you miss a class, try to get lecture notes from a classmate and review them *before* the next lecture. We will use SSU's online course management system, Canvas (https://elearning.salemstate.edu/) to post assignments and announcements regarding the course topics and progress. You will need to visit Canvas (with your SSU Navigator use-name and password) for the course activities. Canvas uses your ***SSU-stored email*** for the communication between you and the instructor and thus you ***must use this***

email address. Each student is responsible for completing all course requirements and for keeping up with all that goes on in the course (whether or not the student is present).

Final Grade:

Final grade will be determined using the following grading weights:

assignments (programming/small projects short-answer exercises, and readings)	35%
midterm examination	10%
final examination	20%
semester project and presentation	35%

Attendance is not used to calculate the final grade: however, note that you are at all times responsible for assignments and materials presented in class.

The following table shows how the course work is assessed against the course objectives:

	Exams	Assignments(short-answer questions, programming/small projects, and readings)	Semester Project and Presentation
CO01	✓	✓	
CO02	✓	✓	✓
CO03	✓	✓	✓
CO04	✓	✓	✓
CO05	✓	✓	
CO06	✓	✓	
CO07	✓	✓	
CO08	✓	✓	✓

Student-Instructor Communication:

Learning how to develop software is very much a **hands-on, experiential process** - the only way to be sure that you understand the material is to apply it by designing and writing programs. The nature of programming is such that it is relatively easy to "get stuck" on minor technical topics that can be difficult to recognize, particularly at early stages of this course - this can lead to a significant amount of what feels like wasted time. While the single most effective way to deal with these problems is to talk to the course instructor, that approach can be problematic if the class meets only once or twice a week and/or if the instructor's office hours conflict with students' obligations.

If you have any questions regarding course material, and *in particular if you are having problems with a programming project*, the most effective way to get assistance is to *discuss with the instructor (either in the class or outside the classroom).*

Assignments (Lab Exercises/Programming Projects/Short-Answer Exercises):

Different exercises (including short-answer exercises, programming projects, small projects, reading assignments) will be assigned during the semester. Many exercises *will definitely focus on programming practices and the use of toolkits as a preparation for your final/semester project* (*see below*). Submission requirements and grading mechanics will be stated on each exercise. In general, each exercise will have an assigned due date and time: the required material(s) are to be submitted no later than midnight of that date. For nearly every assignment, there will be a short demo and presentation of the assignment result during the class meeting immediately after the deadline and this presentation/demo is a portion of the assignment grading. Please

refer to Final Grade above for the grading weight of the assignments.

Readings will be assigned from the text on a regular basis: for the maximum benefit from reading, do the readings before the material is covered in class. Supplementary material will be distributed on a regular basis, and will be the primary focus of class discussions. Occasional worksheets and problems will be assigned.

Semester Project and Presentation:

There will be one semester project and the project result will be presented at the end of the semester. Students can choose any visualization related topics as their final/semester projects *upon the instructor's permission*. For this assignment, the following materials should be submitted by their indicated due dates respectively : (1) semester project proposal (a brief description of the project and what it to be done and what would be the expected results), (2) semester project progress report (of what has been done and what will be done and temporary results), and (3) semester project portfolio including a formal project write-up/report, programming code, all project documents/audios/videos, and presentation documents.

Semester project and presentation is a major portion of the course work and therefore a main portion of the course grade. Please start on the semester project from the very beginning of the semester. *Excellent work on the semester project will receive bonus credits*, which is usually earned through the presentation of the project in a conference, SSU undergraduate research symposium in May, and etc. Working on *a real world, practical problem* is strongly encouraged for your semester project.

Exams:

There will be two exams, a midterm (usually in week 8) examination and a *comprehensive* final examination. Check the above for examination grading weights and times.

Missed Tests:

Tests (exams and quizzes) may not be made up except for *documented emergency* situations. If a test must be made up, arrangements must be made with the instructor to take the test before it is discussed in class (usually within a week of the test being administered).

Due Dates/Time:

- You will **lose 50%** of your assignment credits if you turn in your assignment after the deadline and there will be **20% (more) penalty for each week** for your late submission.
- **No assignments (including semester project) will be accepted after the final examination**.
- Should there be an emergency that prevents you from completing your assignments/projects on time, you will need to send *an email request* for the extension on the coursework submission. The instructor will reply to this request email with a specific number of days for the extension period or a new deadline for the assignment and you will need to keep *this email as a record of the extension approval*. Only a request email does ***not*** guarantee the extension approval.

Study Groups:

While I strongly encourage study groups, I require that each student hand in his/her answers in her/his own words - if two answers are highly similar to each other, neither will receive credit.

When working on your programming projects, you may discuss with others the project topics, the algorithms and methodologies related to the project; but when you work on writing the code, this coding work should be 100% of your own work. **If two answers/written code segments come out exactly the same or highly similar, neither will receive credit and/or further actions will be taken** (such as reporting to the department and/or university). Given the nature of most of the projects, homework questions and writing assignments, it will be almost impossible for two people to come up with highly similar answers UNLESS they copy.

Academic Integrity:

Academic Integrity Policy and Regulations can be found in the University Catalog and on the University's website (http://catalog.salemstate.edu/content.php?catoid=13&navoid=1295#Academic_Integrity). The formal regulations are extensive and detailed - familiarize yourself with them if you have not previously done so. A concise summary of and direct quote from the regulations: "Materials (written or otherwise) submitted to fulfill academic requirements must represent a student's own efforts". *Submission of other's work as one's own without proper attribution is in direct violation of the University's Policy* and will be dealt with according to the University's formal Procedures.

All students are expected to be familiar with the academic regulations, including those regarding Academic Integrity, for

Salem State University as published in the college catalog. In addition, each student is responsible for completing all course requirements and for keeping up with all that goes on in the course (whether or not the student is present).

Salem State University is committed to providing equal access to the educational experience for all students in compliance with Section 504 of The Rehabilitation Act and The Americans with Disabilities Act and to providing all reasonable academic accommodations, aids and adjustments. Any student who has a documented disability requiring an accommodation, aid or adjustment should speak with the instructor immediately. Students with Disabilities who have not previously done so should provide documentation to and schedule an appointment with the Office for Students with Disabilities and obtain appropriate services.

In the event of a university declared critical emergency, Salem State University reserves the right to alter this course plan. Students should refer to http://www.salemstate.edu/ for further information and updates. The course attendance policy stays in effect until there is a university declared critical emergency. In the event of an emergency, please refer to related course announcement and alternative study guide and materials at Canvas (https://elearning.salemstate.edu/) by logging to the course link at Canvas . Students should review the plans and gather all required materials before an emergency is declared.

Please remember that if, for any reason, you decide to drop this course, you **MUST** do so officially through the Registrar's office. The last day to withdraw from a course this semester is **April 15th**.

Note: This syllabus represents the intended structure of the course for the semester. If changes are necessary, students will be notified in writing and via all regular class communication mechanisms (class discussion, emails, and/or the course link at Canvas (https://elearning.salemstate.edu/).