IUPUI

SCHOOL OF INFORMATICS AND COMPUTING

DEPARTMENT OF HUMAN-CENTERED COMPUTING

Indiana University–Purdue University Indianapolis

INFO H517
Visualization Design, Analysis, and Evaluation

Department of Human-Centered Computing
Indiana University School of Informatics and Computing, Indianapolis
Fall 2016

Section No.:	35557 *Credit Hours:* 3
Time:	Wednesdays 12:00 – 2:40 PM
Location:	IT 257, Informatics & Communications Technology Complex 535 West Michigan Street, Indianapolis, IN 46202 [map]
First Class:	August 24, 2016
Website:	http://vis.ninja/teaching/h590/

Instructor:	Khairi Reda, Ph.D. in Computer Science (University of Illinois, Chicago) Assistant Professor, Human–Centered Computing
Office Hours:	Mondays, 1:00-2:30PM, or by Appointment
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Prerequisites: Prior programming experience in a high-level language (e.g., Java, JavaScript, Python, C/C++, C#).

COURSE DESCRIPTION

This is an introductory course in design and evaluation of interactive visualizations for data analysis. Topics include human visual perception, visualization design, interaction techniques, and evaluation methods. Students develop projects to create their own web-based visualizations and develop competence to undertake independent research in visualization and visual analytics.

EXTENDED COURSE DESCRIPTION

This course introduces students to interactive data visualization from a human-centered perspective. Students learn how to apply principles from perceptual psychology, cognitive science, and graphics design to create effective visualizations for a variety of data types and analytical tasks. Topics include fundamentals of human visual perception and cognition,

graphical data encoding, visual representations (including statistical plots, maps, graphs, small-multiples), task abstraction, interaction techniques, data analysis methods (e.g., clustering and dimensionality reduction), and evaluation methods. Students develop projects to create their own web-based visualizations using HTML, JavaScript, and D3. Students become conversant with a collection of visualization techniques and develop competence to undertake advanced research in visualization and visual analytics.

Learning Outcomes:

Upon successful completion of this course, students will	RBT[1]	PGPL[2]	Program Outcome	Assessment
1. Assess the purpose, benefits, and limitations of visualization as a human-centered data analysis methodology.	5	1	8	Survey Document
2. Conceptualize and design effective visualizations for a variety of data types and analytical tasks.	6	2, 3	1, 2	Projects 1–3
3. Implement interactive visualizations using modern web-based frameworks.	3, 4	1	1	Projects 1–3
4. Critically evaluate visualizations using perceptual principles and established design guidelines.	5	2	1, 2, 6–8	Design Critiques Projects 1–3
5. Conduct independent research on a range of theoretical and applied topics in visualization and visual analytics.	5	2	7, 8	Survey Document Projects 1–3

Principles of Graduate and Professional Learning (PGPL)

Learning outcomes are assessed in the following areas:

1. Knowledge and skills mastery — Moderate emphasis
2. Critical thinking and good judgment — Major emphasis
3. Effective communication — Some emphasis
4. Ethical behavior

MS in HCI Program Learning Outcomes

Upon completion of the M.S. in HCI program, students will

1. Evaluate and create interfaces by applying HCI theories, terms, principles, and methods including user experience, user-centered, and interaction design theories and practices; interactive product design and development processes and lifecycle; user profiling to interaction design (needs and requirements); system requirements and product assessments; prototype design theory and practice; and product usability evaluations and testing methods.

[1] Revised Bloom's taxonomy: 1. Remember, 2. Understand, 3. Apply, 4. Analyze, 5. Evaluate, 6. Create
[2] Principle of Graduate and Professional Learning

2. Apply psychological and cognitive principles and theories to human factors and user experience design.
3. Research and develop interactive collaborative systems by applying social computing theories and frameworks.
4. Design novel ubiquitous computing systems by researching and applying relevant HCI and informatics theories and frameworks.
5. Design effective, usable, and human-centered interactive systems using prototypes and proof of concepts.
6. Critique interaction designs on their usability, human-centeredness, and satisfaction of requirements, evaluate the fitness of requirements, goals, and research methods, make recommendations, and create and defend alternative designs.
7. Communicate effectively in digital, oral, and written form the processes, ideas, outcomes, and implications of HCI projects.
8. Articulate decisions and reasoning behind decisions made related to interaction design choices, design, and research methods.
9. Exhibit sound judgment, ethical behavior, and professionalism in applying HCI concepts and value-sensitive design to serve stakeholders and society, especially in ethically challenging situations.
10. Collaborate in teams fairly, effectively, and creatively, applying group decision-making and negotiation skills.

Class Structure

The lectures and reading materials will lay the theoretical foundations for visualization design. But the best way to learn how to make effective visualizations is to make a lot of visualizations. Therefore, this course emphasizes project-based learning; There will be three projects in this class with progressing levels of complexity. The goal of the projects is to give students exposure to a variety of data types, visual representations, and interaction techniques. Each project entails:

1) Designing and implementing an interactive visualization for a given dataset and a set of analytical tasks. We will be using JavaScript and D3 as the main development platform.
2) Documentation of the design process and justification of your design choices.
3) Presentation and critique of the project in class.

In addition to projects, we will have a series of design critique discussions throughout the class. We will select a set of published, interactive visualizations and critique them in class. The goal of the discussion is to learn how to critically evaluate visualizations, and present evidence that suggest their effectiveness based on perceptual principles, guidelines, and established design heuristics. Critical analysis is essential to visualization design and evaluation. The project presentation and in-class discussions will provide students with an avenue to practice these skills. Students will receive feedback from the instructor and their peers during the project presentations, and are expected to take critique as an opportunity to strengthen their work and incorporate feedback into their subsequent projects.

Required Text(s):

We will be using two textbooks for this class; The first deals with the conceptual foundations and theory of visualization design, while the second covers the necessary technical skills for

developing web-based visualizations. We will assign specific chapters for reading every week.

Title:	*Visualization Analysis and Design*
Author:	Tamara Munzner
Publisher:	CRC Press, 2014
ISBN:	9781466508910
Website:	http://www.amazon.com/Visualization-Analysis-Design-Peters-Series/dp/1466508914

Title:	*Interactive Data Visualization for the Web*
Author:	Scott Murray
Edition:	Free online edition
Publisher:	O'Reilly, 2013
Website:	http://chimera.labs.oreilly.com/books/1230000000345

Hereafter, we refer to the first as **Munzner's book** and the second as the **D3 book**.

Additional Readings:

We will be supplementing the books with published research papers to cover a breadth of research topics in visualization and visual analytics. The assigned papers for each week (along with the book chapters) should be read before the class.

Exams/quizzes:

There are no exams or quizzes in this course. Instead, your grade will be based on project deliverables, presentation, and in-class participation.

Homework

There is one homework in this class (homework 0). The goal of this homework is to initiate you to the visualization literature and expose you to the types of problems and techniques that are studied/developed by the visualization research community. Your task is to scan previously published papers at the IEEE VIS (http://ieeevis.org/) conference, the primary academic venue for visualization research, and write a 1–2 page survey document.

Projects

The best way to learn how to make effective visualizations is to make a lot of visualizations. There are three projects in the class. For each project, you will be given a dataset along with a set of analytical tasks (or questions) about the data. Your goal is to design and implement an interactive visualization that enables an analyst to explore the given and carry out the specified tasks. Project details will be provided in class. The deliverable for each project will consist of a webpage. The webpage should contain the following components:

1. **The visualization:** This should be a live, working, and interactive instance of your visualization. The visualization should work with the latest version of the Chrome browser.

2. **A 2-4 minutes YouTube video** showing the use of your visualization with narration. The video should be created using a screen-capture tool while interacting with the visualization. This video should ideally be similar in style to the videos that accompany papers at the IEEE VIS or ACM CHI conferences. Here are a couple of good examples:
    a. LineUp: https://www.youtube.com/watch?v=iFqCBI4T8ks
    b. GPLOM: https://www.youtube.com/watch?v=AtbIeCvB-E0
3. **Project write-up:** This will essentially document your design process, and should provide rigorous rationale for the design choices you made. In theory, you should be able to explain the contribution of every pixel in your visualization. Also note that visualization design is an iterative process, so be sure to document your design with sketches and/or screenshots (including, possibly, the failed attempts).
4. **The source code of your visualization:** in a downloadable ZIPed package.

The first project will be an individual project. The second and third will be group projects in which you will be forming teams of 2-3 students. You can choose your group or we will team you up randomly. The instructor will provide a dataset in the first two projects and set the requirements and constraints on how the solution should be. In the third project, you will have the freedom to propose your own problem space and dataset. That is, you will search for a dataset that is of interest to you, define a set of analytical questions about the dataset, and then propose, design, and implement a visualization.

By the time you finish the third project, you should have an online visualization portfolio of your own creation. It is therefore highly-recommended that you spend some effort on creating polished webpages, and plan on keeping them alive beyond the duration of the course. There are numerous free hosting services that you can utilize to host your project pages (e.g., Google Sites). Alternatively, you may use your university-provided personal web-space to host your project.

Project presentation

For every project you (as an individual or as a team) will need to present your project. The presentation will essentially be a live demonstration of your visualization to the class. You will explain the visual encodings you used and illustrate the interactions you implemented. We will schedule the presentation in advance so that you know on what day/time you will be presenting. We will figure out how much time we have for each presentation based on the number of groups in the class, but typically this will be about 5-7 minutes with 2 minutes for questions. This is a hard time limit! If you go over time, you will be interrupted. You should therefore rehearse your presentation and make sure you stay on time, leaving room for questions and critique.

Visualization design critique

We will have between 3-5 visualization design critiques throughout the lectures. The design critique is a group activity in which we will take an interactive, online-published visualization (for instance, from online news websites such as the NYTimes or the Guardian) and critique it in class. We will pick a diverse range of visualization designs. The critique will focus on the following questions:

- What is the data represented in the visualization?

- Are there any transformations applied to the data? Are the transformation clear and transparent?
- What are the marks and perceptual channels used to communicate the data attributes? Are they a good match for the attribute types?
- What do the different views represent, if any? What are the interactions used?
- What questions about the data can we answer with the visualization? What questions can not be answered?
- What are some of the insights that we can gain after playing with the visualization?
- Do you like the visualization? Is it appealing? Does it have the potential to engage audience?
- Overall, was the visualization effective in communicating the intended information? What would you have done differently?

Grading Information:

	Deliverable	**Grade**
Homework 0	Survey document	10%
Project 1	Complete, working visualization with source code	10%
	Documentation and video	5%
	Presentation	5%
Project 2	Complete, working visualization with source code	15%
	Documentation and video	5%
	Presentation	5%
Project 3	Complete, working visualization with source code	20%
	Documentation and video	10%
	Presentation	5%
Participation in design critique discussions		10%

Participation in design critique discussions

Participation in the design critique discussions will be evaluated according to the following rubric:

0 points: Not physically present OR behaved in ways that were a distraction to the learning environment

1 point: Not mentally present OR was engaged in other activities not related to the discussion

2 points: Was consistently engaged, listening to the discussion

3 points: Contributed productively to the discussion once or twice

4 points: Contributed productively to the discussion three or more times

Grading Scale:

A+	97 – 100	Outstanding achievement
A	93 – 96.99	Excellent achievement
A–	90 – 92.99	Very good quality of work

B+	87 –	89.99	Good quality of work
B	83 –	86.99	Modestly acceptable quality of work
B–	80 –	82.99	Marginal acceptable quality of work
C+	77 –	79.99	Unacceptable work
C	73 –	76.99	Unacceptable work

No credits toward major, minor, or certificate requirements are granted for a grade below B–.

EXPECTATIONS, GUIDELINES, AND POLICIES

Collaboration Policy

You are welcome (and encouraged) to discuss the projects and homeworks with others in order to better understand it, but the work you turn in must be your own (or for the project, yours and your teammate's). That is, you must write your own code, design your own visualizations, and critically evaluate the results in your own words. You may not submit the same or similar work to this course that you have submitted to another. Nor may you provide or make available solutions to homeworks or projects to individuals who take or may take this course in the future.

Quoting Sources

You must acknowledge any source code that was not written by you by mentioning the original author(s) directly in your source code (comment or header). You can also acknowledge sources in a README.txt file if you used whole libraries. Do not remove any original copyright notices and headers. However, you are encouraged to use libraries, unless explicitly stated otherwise.

You may use examples you find on the web as a starting point, provided its license allows you to re-use it. You must quote the source using proper citations (author, year, title, time accessed, URL) both in the source code and in your project webpages. You may not use existing complex combinations or large examples. For example, you may not use a ready to use multiple linked view visualization. However, you may use parts out of such examples.

Attendance:

A basic requirement of this course is that you will participate in all class meetings, whether online or face-to-face, and conscientiously complete all required course activities and assignments. Class attendance is required for classroom-based courses. It entails being present and attentive for the entire class period. Attendance shall be taken in every class. If you do not sign the attendance sheet while in class, you shall be marked absent. Signing the attendance sheet for another student is prohibited. The instructor is required to submit to the Registrar a record of student attendance, and action shall be taken if the record conveys a trend of absenteeism.

Only the following are acceptable excuses for absences: death in the immediate family (e.g. mother, father, spouse, child, or sibling), hospitalization or serious illness; jury duty; court ordered summons; religious holiday; university/school coordinated athletic or scholastic activities; an unanticipated event that would cause attendance to result in substantial hardship to one’s self or immediate family. Absences must be explained with the submission of appropriate documentation to the satisfaction of the instructor, who will decide whether missed work may be made up. Absences that do not satisfy the above criteria are considered

unexcused. To protect your privacy, doctor's excuses should exclude the nature of the condition and focus instead on how the condition impacts your attendance and academic performance.

Missing class reduces your grade through the following grade reduction policy: You are allowed two excused or unexcused absences. Each additional absence, unless excused, results in a 5% reduction in your final course grade. More than four absences result in an F in the course. Missing class may also reduce your grade by eliminating opportunities for class participation. For all absences, the student is responsible for all covered materials and assignments.

Incomplete:

The instructor may assign an Incomplete (I) grade only if at least 75% of the required coursework has been completed at passing quality and holding you to previously established time limits would result in unjust hardship to you. All unfinished work must be completed by the date set by the instructor. Left unchanged, an Incomplete automatically becomes an F after one year. Please see the following for university policy on Incomplete grades: http://registrar.iupui.edu/incomp.html

Deliverables:

You are responsible for completing each deliverable (e.g., projects, homeworks) by its deadline and submitting it by the specified method. Deadlines are outlined in the syllabus. Should you miss a class, you are still responsible for completing the deliverable and for finding out what was covered in class, including any new or modified deliverable. In fairness to the instructor and students who completed their work on time, a grade on a deliverable shall be reduced 10%, if it is submitted late and a further 10% for each 24-hour period it is submitted after the deadline.

WEEKLY SCHEDULE

Date	Topic	Readings, homework, and projects
Aug 24	Introduction; Brief history of visualization; How to not lie with visualization; Basics of the web stack: HTML and JavaScript	**Homework 0 out** **Recommended reading:** • Video: Information Visualization for Scientific Discovery. M. Meyer. TEDxWaterloo talk: https://www.youtube.com/watch?v=Sua0xDCf8MA • Video: Why Visual Analytics--a conversation: https://www.youtube.com/watch?v=5uGRGqCFryg • Video: The beauty of data visualization. D. McCandless. TED talk: http://www.ted.com/talks/david_mccandless_the_beauty_of_data_visualization • Paper: A tour through the Visualization Zoo. J. Heer, M. Bostock, V. Ogievetsky. Communications of the ACM 53(6):59-67, 2010 • Paper: The Value of Visualization. J. van Wijk. Proceedings of the IEEE Visualization Conference. pp. 79-86, 2005
Aug 31	JavaScript, SVG, and D3	**Homework 0 due** **Project 1 out**

		Required reading: • D3 book: chapters 1, 2, 3, 4, 5 • Munzner's book: chapter 1
Sep 7	What is visualization research? Advanced D3;	**Required reading:** • Paper: Process and Pitfalls in Writing Information Visualization Research. Tamara Munzner, 2008. URL: https://www.cs.ubc.ca/labs/imager/tr/2008/pitfalls/pitfalls.pdf • D3 book: chapters 6, 7, 8, 9
Sep 14	Fundamentals of visual perception and cognition;	**Project 1 milestone** **Required reading** • Visual Thinking for Design. C. Ware: chapters 1, 2, 4 (available from Elsevier's ScienceDirect: http://www.sciencedirect.com/science/book/9780123708960) • Paper: Why a Diagram is (Sometimes) Worth Ten Thousand Words. J. H. Larkin, H. A. Simon. Cognitive Science 11:65-99, 1987 **Recommended reading** • Perception in Visualization. C. Healey: https://www.csc.ncsu.edu/faculty/healey/PP/index.html • Paper: Representing Colors as Three Numbers. M. Stone. IEEE Computer Graphics and Applications, 25(4):78-85, 2005 • Gestalt principles (part 1). B. Wong. Nature Methods: http://www.nature.com/nmeth/journal/v7/n11/full/nmeth1110-863.html • Gestalt principles (part2). B. Wong. Nature Methods: http://www.nature.com/nmeth/journal/v7/n12/full/nmeth1210-941.html
Sep 21	Marks, channels, and data types	**Required reading** • Munzner's book: chapters 2, 5, 6 • Paper: The Cognitive Science of Visual-Spatial Displays: Implications for Design. M. Hegarty. Topics in Cognitive Science 3(2011):446-474, 2011 **Recommended reading** • Paper: Graphical Perception: Theory, Experimentation, and the Application to the Development of Graphical Models. W. S. Cleveland, R. McGill. Journal of American Statistical Association 79(387): pp. 531-554, 1984 • Paper: Crowdsourcing Graphical Perception: Using Mechanical Turk to Assess Visualization Design. J. Heer, M. Bostock. Proceedings of the ACM CHI'10 conference, 2010
Sep 28	Tables and charts;	**Project 1 due** **Project 2 out** **Required reading**

	Time series	• Munzner's book: chapters 7 • Paper: LiveRAC: Interactive Visual Exploration of System Management Time-Series Data. P. McLachlan, T. Munzner, E. Koutsofios, S. North. Proceedings of the ACM CHI'08 conference, 2008 • Paper: Graphical Perception of Multiple Time Series. W. Javed, B. McDonnel, N. Elmqvist. IEEE Trans. Visualization and Computer Graphics 16(6):927-934, 2010
Oct 5	**Project 1 presentations**	
Oct 12	Interaction, navigation, and Multiple Views	**Required reading** • Munzner's book: chapters 11, 12 • Paper: Beyond Visual Acuity: The Perceptual Scalability of Information Visualizations for Large Displays. Proceedings of CHI'07 conference. pp. 101-110, 2007 • Paper: Interactive Coordinated Multiple-View Visualization of Biomechanical Motion Data. D. Keefe, M. Ewert, W. Ribarsky, R. Chang. IEEE Trans. Visualization and Computer Graphics 15(6):1383-1390, 2009 **Recommended reading** • Paper: A Review of Overview+Detail, Zooming, and Focus+Context Interfaces. A. Cockburn, A. Karlson, B. Bederson. ACM Transactions on Human-Computer Interaction 41(1), 2009 • Paper: Zooming versus multiple window interfaces: Cognitive costs of visual comparisons. M. Plumlee, C. Ware. ACM Transactions on Computer-Human Interaction 13(2):179-209, 2006 Paper: Exploring the Design Space of Composite Visualization. W. Javed, N. Elmqvist. Proceedings of the IEEE Pacific Visualization Symposium, pp. 1-8, 2012
Oct 19	Trees, networks, and maps	**Project 2 milestone** **Required reading** • Munzner's book: chapters 8, 9 • Paper: Visualizing the Evolution of Community Structures in Dynamic Social Networks. K. Reda, C. Tanti, A. Johnson, J. Leigh, T. Berger-Wolf. Computer Graphics Forum 30(3): 1061-1070, 2011 • Paper: "Search, Show Context, Expand on Demand": Supporting Large Graph Exploration with Degree of Interest. F. van Ham, A. Perer. IEEE Trans. Visualization and Computer Graphics, 15(6), 2009 **Recommended reading** • Paper: Visualizing Dynamic Networks with Matrix Cubes. B. Bach, E. Pietriga, J-D. Fekete. Proceedings of the ACM CHI'14 conference, 2014 • Paper: NodeTrix: a Hybrid Visualization of Social Networks. N. Henry, J-D. Fekete, M. McGuffin. IEEE Trans. Visualization and Computer Graphics 13(6): 1302-1309, 2007

Oct 26		**Class canceled - Instructor on travel at the IEEE VIS conference**
Nov 2	Visualization tasks; Evaluating visualizations	**Project 2 due** **Required reading** • Munzner's book: chapter 3, 4 • Paper: Toward Measuring Visualization Insight. C. North. IEEE Computer Graphics and Applications 26(3):6-9, 2006 • Paper: The effects of Visual Embellishment on Comprehension and Memorability of Charts. S. Bateman, R. Mandryk, C. Gutwin, D. McDine, C. Brooks. Proceedings of the ACM CHI'10 **Recommended readings** • Paper: Low-level Components of Analytic Activity in Information Visualization. R. Amar, J. Eagan, J. Stasko. Proceedings of the IEEE Symposium on Information Visualization, pp. 15, 2005 • Paper: Evaluating Information Visualizations. S. Carpendale. URL: http://innovis.cpsc.ucalgary.ca/innovis/uploads/Courses/InfoVisTutorial2010/read_EvaluatingInfoVis.pdf
Nov 9	**Project 2 presentations**; Peer review and discussion of project 3 proposals	**Project 3 initial proposal due**
Nov 16	Data aggregation, clustering, and reduction; The sense making process	**Project 3 revised proposal due** **Required reading** • Munzner's book: chapter 13 • Paper: The Sensemaking Process and Leverage Points for Analyst Technology as Identified Through Cognitive Task Analysis. P. Pirolli and S. Card. Proceedings of the International Conference on Intelligence Analysis, 2005 • Paper: Space to think: large high-resolution displays for sensemaking. C. Andrews, A. Endert, C. North. Proceedings of the CHI'10 conference, 2010 **Recommended reading** • Paper: How Scientists Think in the Real World: Implications for Science Education. K. Dunbar, Journal of Applied Developmental Psychology 21(1):49-58, 2000 • Psychology of Intelligence Analysis. R. J. Heuer. Chapters 1 and 8: https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/books-and-monographs/psychology-of-intelligence-analysis/PsychofIntelNew.pdf

Nov 23		**No class - Thanksgiving holiday**
Nov 30	Temporal data; Inference and uncertainty visualization	**Required reading** • Paper: Time Curves: Folding Time to Visualize Patterns of Temporal Evolution in Data. B. Bach, C. Shi, N. Heulot, T. Madhayastha, T. Garbowski, P. Dragicevic. IEEE Trans. Visualization and Computer Graphics 21(1), 2016 • Paper: GeoTime information visualization. T. Kapler, W. Wright. Proceedings of the IEEE InfoVis'04 conference, pp. 25-32, 2004 • Paper: Graphical Inference for InfoVis. H. Wickham, D. Cook, H. Hofmann, A. Buja. IEEE Trans. Visualization and Computer Graphics 16(6):973-979, 2010 • Paper: When(ish) is My Bus? User-Centered Visualizations of Uncertainty in Everyday, Mobile Predictive Systems. M. Kay, T. Kola, J. Hullman, S. Munson. Proceedings of ACM CHI'16 conference, 2016
Dec 7	**Project 3 presentations**	
Dec 9		**Project 3 write-up & webpage due**

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CODE OF CONDUCT

All students should aspire to the highest standards of academic integrity. Using another student's work on an assignment, cheating on a test, not quoting or citing references correctly, or any other form of dishonesty or plagiarism shall result in a grade of zero on the item and possibly an F in the course. Incidences of academic misconduct shall be referred to

the Department Chair and repeated violations shall result in dismissal from the program.

All students are responsible for reading, understanding, and applying the *Code of Student Rights, Responsibilities and Conduct* and in particular the section on academic misconduct. Refer to *The Code* > *Responsibilities* > *Academic Misconduct* at http://www.indiana.edu/~code/. All students must also successfully complete the Indiana University Department of Education "How to Recognize Plagiarism" Tutorial and Test. https://www.indiana.edu/~istd You must document the difference between your writing and that of others. Use quotation marks in addition to a citation, page number, and reference whenever writing someone else's words (e.g., following the *Publication Manual of the American Psychological Association*). To detect plagiarism instructors apply a range of methods, including Turnitin.com. http://www.ulib.iupui.edu/libinfo/turnitin

Academic misconduct:

1. **Cheating:** Cheating is considered to be an attempt to use or provide unauthorized assistance, materials, information, or study aids in any form and in any academic exercise or environment.
    a. A student must not use external assistance on any "in-class" or "take-home" examination, unless the instructor specifically has authorized external assistance. This prohibition includes, but is not limited to, the use of tutors, books, notes, calculators, computers, and wireless communication devices.
    b. A student must not use another person as a substitute in the taking of an examination or quiz, nor allow other persons to conduct research or to prepare work, without advanced authorization from the instructor to whom the work is being submitted.
    c. A student must not use materials from a commercial term paper company, files of papers prepared by other persons, or submit documents found on the Internet.
    d. A student must not collaborate with other persons on a particular project and submit a copy of a written report that is represented explicitly or implicitly as the student's individual work.
    e. A student must not use any unauthorized assistance in a laboratory, at a computer terminal, or on fieldwork.
    f. A student must not steal examinations or other course materials, including but not limited to, physical copies and photographic or electronic images.
    g. A student must not submit substantial portions of the same academic work for credit or honors more than once without permission of the instructor or program to whom the work is being submitted.
    h. A student must not, without authorization, alter a grade or score in any way, nor alter answers on a returned exam or assignment for credit.
2. **Fabrication:** A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citation to the sources of information.
3. **Plagiarism:** Plagiarism is defined as presenting someone else's work, including the work of other students, as one's own. Any ideas or materials taken from another source for either written or oral use must be fully acknowledged, unless the information is common knowledge. What is considered "common knowledge" may differ from course

to course.

a. A student must not adopt or reproduce ideas, opinions, theories, formulas, graphics, or pictures of another person without acknowledgment.
b. A student must give credit to the originality of others and acknowledge indebtedness whenever:
    1. directly quoting another person's actual words, whether oral or written;
    2. using another person's ideas, opinions, or theories;
    3. paraphrasing the words, ideas, opinions, or theories of others, whether oral or written;
    4. borrowing facts, statistics, or illustrative material; or
    5. offering materials assembled or collected by others in the form of projects or collections without acknowledgment

4. **Interference:** A student must not steal, change, destroy, or impede another student's work, nor should the student unjustly attempt, through a bribe, a promise of favors or threats, to affect any student's grade or the evaluation of academic performance. Impeding another student's work includes, but is not limited to, the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.
5. **Violation of course rules:** A student must not violate course rules established by a department, the course syllabus, verbal or written instructions, or the course materials that are rationally related to the content of the course or to the enhancement of the learning process in the course.
6. **Facilitating academic dishonesty:** A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct, nor allow another student to use his or her work or resources to commit an act of misconduct.

OTHER POLICIES

1. **Administrative withdrawal:** A basic requirement of this course is that students participate in all class discussions and conscientiously complete all required course activities and projects. If a student is unable to attend, participate in, or complete an assignment on time, it is the student's responsibility to inform the instructor. If a student misses more than half of the required activities within the first 25% of the course without contacting the instructor, the student may be administratively withdrawn from this course. Administrative withdrawal may have academic, financial, and financial aid implications. Administrative withdrawal will take place after the full refund period, and a student who has been administratively withdrawn from a course is ineligible for a tuition refund. Contact the instructor with questions concerning administrative withdrawal.
2. **Civility:** To maintain an effective and inclusive learning environment, it is important to be an attentive and respectful participant in lectures, discussions, group work, and other classroom exercises. Thus, unnecessary disruptions should be avoided, such as ringing cell phones, engagement in private conversations, and other unrelated activities. Cell phones, media players, or any noisy devices should be turned off during a class. Texting, surfing the Internet, and posting to Facebook or Twitter during class are generally not permitted. Laptop use may be permitted if it is used for taking notes or conducting class

activities. Students should check with the instructor about permissible devices in class. IUPUI nurtures and promotes "a campus climate that seeks, values, and cultivates diversity in all of its forms and that provides conditions necessary for all campus community members to feel welcomed, supported, included, and valued" (IUPUI Strategic Initiative 9). IUPUI prohibits "discrimination against anyone for reasons of race, color, religion, national origin, sex, sexual orientation, marital status, age, disability, or veteran status" (Office of Equal Opportunity). Profanity or derogatory comments about the instructor, fellow students, invited speakers or other classroom visitors, or any members of the campus community shall not be tolerated. A violation of this rule shall result in a warning and, if the offense continues, possible disciplinary action.

3. **Communication:** For classroom-based courses, the instructor or teaching assistant should respond to emails by the end of the next class or, for online courses, within two Indiana University working days, which excludes weekends and holidays. The instructor should provide weekly office hours or accept appointments for face-to-face, telephone, or teleconferenced meetings, and announce periods of extended absence in advance.

4. **Counseling and Psychological Services (CAPS):** Students seeking counseling or other psychological services should contact the CAPS office by phone at 274-2548 or email at capsindy@iupui.edu. For more information visit http://life.iupui.edu/caps/.

5. **Course evaluations:** Course evaluations provide vital information for improving the quality of courses and programs. Students are urged to complete one course and instructor evaluation for each section in which they are enrolled at the School of Informatics and Computing with the following three exceptions: (a) The student has withdrawn from the course; (b) fewer than five students are enrolled in the section (in which case maintaining anonymity is difficult); and (c) the section is a laboratory that must be taken with a course having a different section number. Course evaluations are completed at https://soic.iupui.edu/app/course-eval/. Course evaluations are typically open from the eleventh week. Course evaluations are anonymous, which means that no one can view the name of the student completing the evaluation. In addition, no one can view the evaluation itself until after the instructor has submitted the final grades for the course. In small sections, demographic information should be left blank, if it could be used to identify the student.

6. **Disabilities policy:** In compliance with the Americans with Disabilities Act (ADA), all qualified students enrolled in this course are entitled to reasonable accommodations. Please notify the instructor during the first week of class of accommodations needed for the course. Students requiring accommodations because of a disability must register with Adaptive Educational Services (AES) and complete the appropriate AES-issued before receiving accommodations. The AES office is located at UC 100, Taylor Hall (Email: aes@iupui.edu, Tel. 317 274-3241). Visit http://aes.iupui.edu for more information.

7. **Email:** Indiana University uses your IU email account as an official means of communication, and students should check it daily for pertinent information. Although you may have your IU email forwarded to an outside email account, please email faculty and staff from your IU email account.

8. **Emergency preparedness:** Safety on campus is everyone's responsibility. Know what

to do in an emergency so that you can protect yourself and others. For specific information, visit the emergency management website. http://protect.iu.edu/emergency

9. **IUPUI course policies:** A number of campus policies governing IUPUI courses may be found at the following link: http://registrar.iupui.edu/course_policies.html
10. **No class attendance without official enrollment.** Only those who are officially enrolled in this course may attend class unless they are are enrolled as an auditor or making up an Incomplete by prior arrangement with the instructor. This policy does not apply to those assisting a student with a documented disability, serving in an instructional role, or administrative personnel. http://registrar.iupui.edu/official-enrollment-class-attendance.html Children may *not* attend class with their parents, guardians, or childcare providers.
11. **Right to revise:** The instructor reserves the right to make changes to this syllabus as necessary and, in such an event, will notify students of the changes immediately.
12. **Student advocate:** The Student Advocate provides assistance to students with personal, financial, and academic issues. The Student Advocate Office is located in the Campus Center, Suite 350. The Student Advocate may also be contacted by phone at 317 274-4431 or by email at studvoc@iupui.edu. For more information visit http://studentaffairs.iupui.edu/advocate.

MISSION STATEMENT

The Mission of IUPUI is to provide for its constituents excellence in

- Teaching and Learning;
- Research, Scholarship, and Creative Activity; and
- Civic Engagement.

With each of these core activities characterized by

- Collaboration within and across disciplines and with the community;
- A commitment to ensuring diversity; and
- Pursuit of best practices.

IUPUI's mission is derived from and aligned with the principal components—Communities of Learning, Responsibilities of Excellence, Accountability and Best Practices—of Indiana University's Strategic Directions Charter.

STATEMENT OF VALUES

IUPUI values the commitment of students to learning; of faculty to the highest standards of teaching, scholarship, and service; and of staff to the highest standards of service. IUPUI recognizes students as partners in learning. IUPUI values the opportunities afforded by its location in Indiana's capital city and is committed to serving the needs of its community. Thus, IUPUI students, faculty, and staff are involved in the community, both to provide educational programs and patient care and to apply learning to community needs through service. As a leader in fostering collaborative relationships, IUPUI values collegiality, cooperation, creativity, innovation, and entrepreneurship as well as honesty, integrity, and support for open inquiry and dissemination of findings. IUPUI is committed to the personal

and professional development of its students, faculty, and staff and to continuous improvement of its programs and services.