Instructor Information
Instructor: Rahul Singh, PhD
E-Mail: rahul@uncg.edu
Office: 481, Bryan Building
Office Hours: Tuesdays 2 to 5 pm.
Other times by Appointment.

Catalog Description
Data are analyzed to answer questions. Students are exposed to concepts and techniques to understand analytics results and appropriately infer relationships to answer questions and visualize results using contemporary techniques.

Student Learning Outcomes
Upon successful completion of this course students will be able to:
1. Analyze business problems to evaluate and design effective visualization strategies
2. Develop effective visualizations using contemporary software applications.
3. Apply principles of effective data visualization to inform problem solving strategies.
5. Evaluate visualization techniques and applications for problem solving.

Required Materials:
Books:
You are not required to buy any specific textbooks for the course.

The following books available for you to download in the library as eBooks. I encourage you to download and review these books.


The first two provide perspective on design strategies for information visualization and guide your understanding of data visualization as a means of exploring and communicating information.

The second two are essentially professional guides to help you learn the two main software tools (Tableau and R) that we will use to build visualization solutions and interpret results to design problem solving strategies. They guide your understanding and provide reference for the two primary technology platforms that we will work with in this course – Tableau and R. I will share additional materials and references for course materials on canvas.

Please note that there are multiple books, guides and references available for both Tableau and R. My choice of text reflects my desire to manage the cost of textbooks, while maintaining the quality of materials and coverage of concepts and technologies for the course.

I encourage you to explore alternative, and perhaps more current, resources for Tableau and R that are readily available on the web and find what work for you. Please share your finds and preferences with the rest of the class.

**Canvas Learning Management System:**
UNCG Canvas is available at https://canvas.uncg.edu. Course materials, announcements and updates will be posted on Canvas regularly. Please check canvas regularly.

**Development Environments**
The Gartner Magic quadrant provides guidance on the choice of platforms:
We will use Tableau and R as visualization tools in this course. I do not expect you to have any prior experience with either Tableau or R. Depending on time and our progress, I plan to introduce SAS or Power BI as an additional environment for your learning – we will discuss more about that in class.

Tableau is available for students as a free download at https://www.tableau.com/academic/students. I will provide access keys and a guide to downloading and installing Tableau for you in canvas.

We will use R Studio (https://www.rstudio.com/) to design and develop analytics and visualizations in R. R is a programming language and free software environment for statistical computing and graphics supported by the R Foundation for Statistical Computing. R Studio is an Integrated Development Environment to build R analyses and visualizations.

Towards the latter half of the course, depending on available time and our progress, we will also briefly cover other visualization technologies such as Microsoft Power BI or SAS Enterprise Guide or SAS Viya. SAS software is available to you as part of the university license with SAS. Power BI is the Microsoft Business Intelligence product. As we complete the materials on Tableau and R, I will provide you with specific instructions on how to download and use all the software tools in canvas.

Additional Resources

In learning to develop data visualizations to solve problems, we use books as references and software as tools to solve problems. This is different from the traditional use of books as text books and single software environments – the idea is not to learn the tool, but to use the tool to solve problems. Tools change with time; the principles and ideas do not - this is the focus of the course.

There are multiple resources that you should become aware of and familiar with, that will help you learn the tools and get a better understanding of the environments:

a. Learning Tableau: https://www.tableau.com/learn
b. R Studio Resources: https://www.rstudio.com/resources/
c. An excellent resource, R for Data Science is available at: https://r4ds.had.co.nz/

These will give you examples, complete code as well as documentation and step-by-step guidance on how to build and play with applications. Additional resources will be shared in canvas throughout the course.

Developing visualization is like solving puzzles. The same person may take 2 hours or 20 hours to solve the same problem. My advice to you is – don’t get stuck and don’t get frustrated. I am here to help you learn and master the material. In addition, multiple resources are available for you to view, learn from and adapt into your own solution. We don’t need to re-invent the wheel – we simply need to see how other wheels work in other vehicles and learn from them enough to adapt them into your own.

When (not if) you get stuck, please ask. Ask questions and learn from the multitude of resources available. There will never be a right answer or an exact solution for you are looking for, but discussion communication and online resources will help you find solutions that you can use and solution that you can adapt to find your answer.
The overall learning philosophy of the course follows a process of Discovery Learning (https://www.learning-theories.com/discovery-learning-bruner.html) In discovery learning, you learn by asking questions, by seeing and doing so you can discover the solution to your own problem. You explore and manipulate possible paths and solutions and build your experience to discover processes and answers. Most of the time, the process you engage and the information you seek and assimilate is the most valuable lesson you learn.

We follow a Problem-based Learning (https://en.wikipedia.org/wiki/Problem-based_learning) approach in this course. There is much joy in solving problems. Many times, one begins to feel that the problem is impossible – it is not. Non-trivial problems are challenging – they require your diligence and creativity. Think about when you were learning to ride a bicycle or learning to swim – they seemed impossible and frustrated you till things began to fit together and you felt great that you accomplished the seemingly impossible task – application development is like that. It seems impossible till you get it and then it seems easy in hindsight and it’s a lot of fun – please have fun and as you learn – I require it.

Evaluation and Grading

Grades

Course grades will be based on the following:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Individual Assignments</td>
<td>25%</td>
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<tr>
<td>Group Project</td>
<td>15%</td>
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<tr>
<td>Class Participation</td>
<td>5%</td>
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<tr>
<td>Midterm Exam</td>
<td>25%</td>
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<tr>
<td>Final Exam</td>
<td>30%</td>
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</table>

Total 100%

The following grading scale will be applied to calculate your final letter grade based on the total grades you earn.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>93-100%</td>
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<tr>
<td>A-</td>
<td>90-92%</td>
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<tr>
<td>B+</td>
<td>87-89%</td>
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<tr>
<td>B</td>
<td>83-86%</td>
</tr>
<tr>
<td>B-</td>
<td>80-82%</td>
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<tr>
<td>C+</td>
<td>77-79%</td>
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<tr>
<td>C</td>
<td>70-76%</td>
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<td>F</td>
<td>&lt; 70%</td>
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Assignments:

Designing and developing problem solving strategies constitute a significant aspect of your skill development in this course. Much of this is accomplished through discovering solutions as you solve problems presented in your assignments. Assignments, therefore, are an integral part of your learning in the course.

Students are required to complete each assignment and submit them on time. All assignments will be due at 11:59 pm on the assigned due date. Assignments submitted after their due dates may be
accepted with penalty based on valid reasons and documented cause, following discussion with the instructor. Materials in subsequent assignments often build on previous ones. Delayed submission, therefore, have a carry-over effect. Please make every possible effort to stay on time with your assignments.

**Group Project**

A group project, over the semester, allows you to apply your skills to build an overall visualization that tells a story and informs decisions regarding a domain of your interest. You can use either Tableau, R as well as a combination of platforms. You can choose a different platform if you like – please discuss it with me before-hand. For the project, you will submit (Specific submissions dates are provided in the tentative schedule):

- **Proposal** - that details the nature of questions you will answer with the data, the source and information about the data you will use, the form your visualization will take (in broad terms) and the members of your group.

  While I suggest you propose the platform/tools you intend to use, you may change these during the progression of the course. Please inform me of the change – unapproved changes will result in loss of points.

  The proposal should be no more than 2 pages and address all the items discussed above.

- **Interim Report** – An interim progress report of the progress and preliminary findings if any. The primary content of the interim report will be the data preparation and analysis you have done, along with any preliminary insights or findings that emerge. The interim report should include your plan for completing the project and expected process and results.

  Submit a document of no more than 5 pages (put any charts or tables as appendices) that describes your process and preliminary findings.

- **Presentation**: Submit a video presentation using any tool of your choice that outlines the overall findings of your project. The primary purpose of the presentation is to showcase the analysis you have done using the platform you chose. Think about a narrated walkthrough of a storyboard or set of dashboards and present the implications of your analysis.

- **Final Report**: The final report should have an executive summary of your findings and the key outcomes from your analysis as well as a discussion of the implications of your work and suggested next steps.

  The report should be no more than 10 pages long (+ 1 page of the executive summary). Provide summary and aggregate visualizations that support your findings. Any additional charts and tables may be submitted as appendices.

  The final submission should include your final analysis tool in the form of an R Project or Tableau file (or the output of the tool you choose).
Participation
Student are expected to regularly discuss their progress in the course and participate in discussions using WebEx and the topic/assignment specific discussion boards on canvas.

Exams
We will have a mid-term and a final exam. We will go over more information about the exams as the semester progresses.

Additional Information

Attendance Policy:
It is the student’s responsibility to attend class and to participate in class discussions. It is the student’s responsibility to stay on track with readings and assignments to be successful in the course.

Canvas:
You must check your Canvas course regularly. I may send email updates or add new info on Canvas on an ongoing basis. You will be responsible for any information or announcements provided to you through email and for any updates on Canvas.

e-Mail:
- Always include a subject line.
- Remember without facial expressions some comments may be taken the wrong way. Be careful in wording your emails. Use of emoticons might be helpful in some cases.
- Use standard fonts.
- Do not send large attachments without permission.
- Special formatting such as centering, audio messages, tables, html, etc. should be avoided unless necessary to complete an assignment or other communication.
- Respect the privacy of other class members

- Please Note: E-mail is my preferred method of communication. Please do not send email over canvas – it gets lost in Gmail's organization of Updates and Forums and I am not able to respond as promptly as I would like. Please send email directly to my email address: rahul@uncg.edu

Netiquette:
The same guidelines that apply to traditional classes should be observed in the virtual classroom environment. Please use proper netiquette when interacting with class members and the professor.

Policy on Server Unavailability or Other Technical Difficulties:
The university is committed to providing a reliable online course system to all users. However, in the event of any unexpected server outage or any unusual technical difficulty which prevents students from completing a time sensitive assessment activity, the instructor will extend the time windows.

What you need to take this course:
1. Textbooks, Tableau and RStudio.
2. You must have access to a computer that connects to the Internet. The course materials are only accessible online by logging in to canvas.uncg.edu - your student identification number is required. If you do not own a computer, the computer labs on campus will be open during this
3. You must have a working e-mail account. Your first assignment will be to update your e-mail address on the course Web site. Instructions are online at canvas.uncg.edu - you must log in to see the course materials.

4. Because of e-mail viruses, you must use the subject ISM 646 and your full name typed in the message, or the e-mail may be ignored.

5. If you have questions, please do not respond to a Canvas Announcement, rather send me a direct email.

6. You must check your e-mail account regularly throughout the semester. Official announcements will be made by e-mail, and on the course Web site at canvas.uncg.edu.

7. You are responsible for saving all assignments correctly, so you can turn them in electronically. You should be comfortable using word processing software, programming software and have reasonable keyboarding skills. No assignments will be accepted in handwritten form.

8. Supplies: Although you will be publishing (uploading) your assignments, it's a good idea to keep copies of everything.

Academic Integrity Policies:

Students in the Bryan School must conform to all existing principles found in UNCG’s Academic Integrity Policy and the Student Code of Conduct. Further details may be found at the following site: http://sa.uncg.edu/handbook/

Expectations of Faculty and Students in the Bryan School:

Students should read the Guidelines for Faculty and Students presented on the web pages found at: http://bryan.uncg.edu/wp-content/uploads/2012/08/faculty_student_guidelines.pdf

A note about learning:

Students learn best in quite different ways. One of the advantages of the online format of the course is that it allows students to approach the course in ways that suit their personal styles and preferences. In classrooms, instructors are inclined to teach either as they themselves were taught, or as they think "the average student" prefers. Online, all of the instructor-presented class material is laid out at once, and students can do with it whatever they prefer in order to learn in as personal and unique a fashion as possible.

To understand how you might learn best and how you might approach the course, it's suggested that you complete a learning style inventory, use the information given to figure and interpret your score, and plan your learning strategy accordingly. Another couple of online tools of this sort are the Keirsey Temperament Questionnaire (http://www.keirsey.com/sorter/register.aspx) and the Keirsey Character Questionnaire (http://www.keirsey.com/).

This course by design specifically accommodates different learning styles by involving a variety of components, including text, video clips, self-check quizzes, reference lists, online discussion, blogs and wikis. Since you are probably used to learning more or less as prescribed or required by a classroom teacher and are not used to designing your own learning strategy, it might take a little time to do that and to settle into a comfortable routine. I think you'll find that as you figure out on your own (and with the help of the online questionnaires mentioned) how to learn the material, everything will fall into place. Online learning, you will find, is quite different than classroom learning. It requires different attitudes, responsibilities, and communication skills.
Topics and Tentative Schedule

This schedule is tentative.

Modification and adjustment may be required during the semester. You will be notified on any changes on canvas. More details will be provided regarding specific due dates and times on canvas.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Deliverables</th>
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<tr>
<td></td>
<td><strong>Week 1:</strong> 1/14 <strong>Orientation and Introduction</strong></td>
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<td></td>
<td>Understanding the nature of data and data analytics. Appreciating the need for effective data visualization.</td>
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<td><strong>Week 2:</strong> 1/21 <strong>Tableau Fundamentals. Working with Data. Building Visualizations with Tableau.</strong></td>
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<td><strong>Week 3:</strong> 1/28 <strong>Working with Data and Aggregations. Building charts and dashboards.</strong></td>
<td>Group Project Proposal Due.</td>
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<td><strong>Week 4:</strong> 2/04 <strong>Formatting Table data and building data visualization.</strong></td>
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<td><strong>Week 5:</strong> 2/11 <strong>Telling stories with data – advanced visualizations with Dashboards and Stories in Tableau</strong></td>
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<td><strong>Week 6:</strong> 2/18 <strong>Fundamentals of R</strong></td>
<td>Tableau Assignment</td>
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<td><strong>Week 7:</strong> 2/25 <strong>Preparing data to build analytics - Cleaning, Filtering, arranging, selecting and summarizing data in R</strong></td>
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<td><strong>Midterm Exam – Taken online between 02/27 and 03/01 – More details will be provided in class and on canvas.</strong></td>
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<td>3/03 <strong>Spring Break</strong></td>
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<td><strong>Week 8:</strong> 3/10 <strong>Data Analysis with R –</strong></td>
<td>Group Project Interim Report</td>
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<td><strong>Week 9:</strong> 3/17 <strong>Analytics with R.</strong></td>
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<td><strong>Week 10:</strong> 3/24 <strong>Building Visualizations with R.</strong></td>
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<td><strong>Week 11:</strong> 3/31 <strong>Visualizing Analytics with R</strong></td>
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<td><strong>Week 12:</strong> 4/07 <strong>Dashboards and advanced visualization with R and other technologies.</strong></td>
<td>R Assignment</td>
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<td><strong>Week 13:</strong> 4/14 <strong>Building Visualizations with contemporary analytics technologies.</strong></td>
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<td><strong>Week 14:</strong> 4/21 <strong>Building Visualizations with contemporary analytics technologies.</strong></td>
<td>Group Project Presentations Due.</td>
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<td><strong>Week 15:</strong> 4/28 <strong>Putting it all together – Solving Problems and informing strategies with Visualization. Review for Exam.</strong></td>
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<tr>
<td></td>
<td><strong>Final Exam: Details TBA – follow university schedule</strong></td>
<td>Group Project Final Report Due before final exam opens.</td>
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