

NATIONAL UNIVERSITY OF SINGAPORE
School of Business
Department of Analytics and Operations

DSC4215/DOS4811 Data Visualisation

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Session: Academic Year 2020/2021 Semester 2

Course Outline (*correct as at: 16 Dec 2020*)

Visualisation is an invaluable tool for supporting analysis and decision making in modern business. Students will: (i) manipulate relational data sets, aggregate the data and generate visual representations; (ii) build a thorough understanding of data aggregation processes; (iii) learn to use interactivity to support data exploration and counterfactual (“what-if”) analysis; and (iv) learn how to communicate ideas effectively with data. This course will include a substantial hands-on-learning component, and supports the development of highly marketable skills in visualisation. Applications will be drawn from operations, supply chain management and other aspects of business.

For part of the course, we **may** be working within a semi-flipped learning model wherein you will be responsible for pre-class “reading and watching”, and we will come together and spend more time on higher order skills (application & analysis v.s. recall & understanding). It is the latter which produce value in the workplace. This is an experiment, we will somehow get through content faster, and you will get more practice.

Course Requirements

Students should have familiarity with a spreadsheet application such as Excel at the level of “pivot tables” (“group-by” and “aggregate”). In particular, students should know how to generate one, from data, by manual computation.

Please Read the Outline

All registered students are expected to have read the outline, and to have made an effort to consult it prior to querying the course staff about course matters. **Red all text in red before registering.**

Sections and Scheduling

Sections:

- A1 on Tue 6pm – 9pm (BIZ2-0509 + Virtual)
- A2 on Wed 6pm – 9pm (BIZ2-0509 + Virtual)

The first session will be in-person. Be sure to read the announcements for updates.

Software and Technology

Bring laptops to class. While there is a small theoretical component, this course is dominantly hands-on.

We will use Tableau, a *cross-platform* Business Intelligence software tool, to explore data, create interactive visualisations and develop data-driven presentations. You may download Tableau here: <https://www.tableau.com/products/desktop/download>

Arrangements will be made with Tableau to obtain licenses in bulk. Students may make use of the default 14-day trial in the interim. Outside of the course, students may obtain 1 year student licenses via the website. Student status letters that indicate the duration of enrolment will be required as supporting material. To obtain such a document, follow the instructions at <http://nus.edu.sg/osa/services/student-status-letter.html>.

We will make heavy use of the integrated instant messaging tool in LumiNUS (TeamUp). If you've used Slack (in an internship or otherwise), the interface will be familiar.

The main channel for the class will be #datavis-2021, and the additional (eventually private) sectional channels will be #datavis-2021-tue and #datavis-2021-wed. Join the "TeamUp Team" via [this link](#) and join the class channels.

TeamUp will be used for class participation (e.g.: sharing screenshots for discussion), information dissemination for items that do not rise to the level of a "course announcement", team formation/coordination, and general Q&A. It will be the learner's responsibility to "have a look from time to time" to avoid missing out. Please post all questions of general interest in the main channel, but be sure to check the outline first. (As a matter of general policy, when posed a question of general interest non-publicly, such as over e-mail or direct message, course staff will direct the requester to "post in the main channel".)

An additional persistence layer will be added through shared Google Documents that all may edit. This will be introduced later. Use this for queueing questions, short guides, examples, and recording clarifications. (If you ask a question in-class and it's answered, you may be asked to record your question and your understanding of the resolution. This supports retention.)

Assessment Breakdown

Class Participation	20%
Assignments	20%
Mid-term	30%
Final Group Project	30%

Class Participation (20%)

This component of assessment will be partly based on the instructor's subjective evaluation of the "quality and quantity" of in-class contributions and also on "out-of-class contributions" to the learning of others.

Introductions. Each student should, by the end of the second week of the semester:

- Join the "TeamUp Team" via [this link](#) and join the class channels
- Under Account Settings (click on the ☰ icon to find it) set a nickname and append the last 3 digits plus letter of your matriculation number (e.g.: "John Li (234X)"); this is crucial to be credited for your participation
- Post a selfie with an introduction in #datavis-2021-tue or #datavis-2021-wed as appropriate. Touch on your background, your interests, what you want to get out of the course, and whether you "already have a group"
- Copy this introduction to the shared document for Introductions and Teams for [Tuesday](#) and [Wednesday](#) (follow the links) and start forming teams

Content Sharing. Students should keep a lookout for interesting examples of visualisation in their work or in media, post examples in #datavis-2021-tue or #datavis-2021-wed and briefly (in a few sentences) discuss the visual in the context of what was covered in the course. Each student should post at least two examples with scoring done on a binary basis ("points" or "no points"). Indicate your full name (per LumiNUS) and the "last 3 digits plus letter" of your matriculation number to facilitate scoring (having both makes things easier).

Zoom Classes. When joining a virtual class (over Zoom), please choose your names to include (i) group number (when available), (ii) preferred name, and (iii) "last 3 digits plus letter" of your matriculation number. This facilitates crediting you for participation. Please check item (iii) because that will be what gets scribbled down, and if a match cannot be found, those points will be lost.

Q&A. Students should ask questions in the main TeamUp channel for the class (#datavis-2021) and participation credit may be given to those who help their classmates over TeamUp. Once your answer has been acknowledged as "solving your classmate's problem", organize the question and answer in this [shared document](#) (being sure to identify yourself to receive credit).

As a matter of policy, questions of "have I been credited" will not be entertained. Neither will questions of the precise breakdown of participation. Please expect course staff to act with integrity, treat the class fairly, and act in the general interest of everyone.

Mid-term (30%)

This will be a closed book written examination on Data Aggregation and Encoding Data Visually. During the paper, students may use a 2-sided A4 (handwritten/printed) “personal summary sheet”.

It will be held on 16 Feb 2021 (Tue; 6.30pm – 8.00pm) in Week 6 to avoid the mid-term rush. Please make arrangements to be available in this time slot.

Assignment/Project Submission Guidelines

Following instructions is crucial to enable the instructor and graders to find your assignments and grade efficiently. The course staff reserves the right to rigidly use the submission guidelines to retrieve submissions for grading. (For example, if a PDF file was requested, the course staff is not obligated to look for anything but a PDF file.) **Therefore, please check compliance with the guidelines before and after submission.**

What follows is most of the guidance that will be provided for some assessment components. This is a course for senior students and professionals. Attendees will be expected to interpret the requirements. Please showcase any specialised knowledge/experience that is relevant. While the rest of the outline may be fluid (especially the content schedule), the assessment plan is stable.

The specificity here is meant to be an aid. Deviations are subject to approval: e-mail or contact the course staff over TeamUp. Feel free to use TeamUp to openly engineer “democratic opposition” to the content/assessment plan. The course staff will take the feedback and will certainly not feel too upset, noting that they have the final say.

Individual Assignments (20%)

A Visual Analytics Proposal (20%)

- Context: You are part of a 5000-strong organization and you have identified the need to build a certain “visual report”. Your task is to communicate the need to senior management and get their buy in
- **Task 1: Flesh out the context.** Articulate it under the heading “Background” as if for the board of the company (use appropriate sub-headings):
 - Background: Realistic and “narrow” business problem (or organisational issue)
 - Consumers of the proposed “visual report” and the relevant decisions they make
 - How they make those decisions now
 - Benefits to the business of the new report
 - Relevant data to be collected (and challenges, if any)

- **Task 2: Design a dashboard** (dashboards) that meets (meet) the needs outlined in Task 1
 - Create a Tableau implementation that generates visuals from mock data (In your submission, show only the relevant dashboards and hide everything else.)
 - Provide illustrations of the various use cases (i.e.: clear examples of how decision makers use the visuals to support decision making; the visuals need not be the only input)
- **Task 3: Draft a report** summarizing the work of Task 1 and Task 2.
- The problem scope should be as narrow as possible. Focus.
- Refer the *Final Group Project* section for grading criteria. (Consider only what is relevant.)
 - You should submit:
 - A report with length no more than 8 pages (12pt font; single spaced; no annexes) including images for the important use cases (PDF format) (Note: Shorter is better. Get to the point. “Bottom Line Up Front”)
 - Instances of the dashboard(s) for the various use cases
 - Submit via LumiNUS (A Visual Analytics Proposal folder):
 - Single ZIP file named in the following format [Matriculation Number].zip
 - Include: Report (PDF file)
 - Include: Dashboards (twbx format; check this; a penalty will be applied if this is not adhered to)
 - Include: Data Set (possibly mock data)
 - The total file size limit was 1GB in IVLE, it should be similar in LumiNUS; reduce the size of your data set to stay under this limit (the “double submission of the data” is duly noted and done for convenience)
 - Verify that the submission was successful (e.g.: re-download your submission and open it)
- **Due: Week 11 on Friday at 11.30pm**

Final Group Project (30%)

Project teams will be responsible to seek out a narrowly defined issue with an accompanying data set, apply business analytics solution methodologies (as appropriate), present the situation and findings. The data set need not be “big”, but visualisation **must** play a crucial role.

While business problems from companies/non-profits/charities/etc. are more desirable, students are welcome to create “synthetic data sets”.

Revisiting past projects is not objectionable as long as the dominant type of work done did not relate to data visualisation. **If past project work is being revisited, prior approval from the instructor should be sought.** It is advisable to communicate with the instructor through a private channel in TeamUp (create one for your team, and another including the instructor).

Final submissions are to be uploaded to LumiNUS (to the Final Project folder) should generally be a single ZIP file named in the following format [Day]-[Group Name].zip (where the day should be of the form Mon/Tue/Wed/...). Multi-part zip files will be allowed, in which case the names of the files submitted should take the form [Day]-[Group Name].[ext]

Submissions should contain:

- A report with length no more than 16 pages (12pt font; single spaced; no annexes) including images for the important use cases (PDF format) (Note: Shorter is better. Get to the point. “Bottom Line Up Front”)
- The data set
- A presentation deck (if used in video)
- Dashboards (twbx format; they should also be featured in the report/presentation; check this; a penalty will be applied if this is not adhered to)
- A video presentation of up to 15 minutes (mp4 or mov format; all students should speak and each should be introduced in speech or text captions; being on video is not compulsory)
- Overview of video presentation (a list of: time stamps, topic, current presenter(s), page number and paragraph in report; PDF format; it is recommended to create this as a sketch for your video, and update timestamps after recording your video; this facilitates grading)

Expectations: (i) narrate clearly and pay attention to your body language; (ii) provide but do not dwell on background information; (iii) state business decisions to be made and basis for selection; (iv) show how data visualisation supports decision making or reveals interesting/useful insights; (v) use encodings that are self-evident and explain those that aren't; (vi) anticipate and address questions that might naturally arise; (vii) make good use of filters/parameters; and (viii) all team members should be involved. Projects demonstrating domain insight and/or technique will be more highly regarded. Where useful, bring in external data and use data analytics methodologies.

As senior students, substantial independence/resourcefulness and some level of production quality is to be expected. Recordings from mobile phone cameras are acceptable as long as content is clear, large enough and stable. It is recommended that you consider the use of screen-recording or video editing software, many free options are available and you are responsible to identify suitable tools. Submit something that you would be proud of.

Submissions are Due: Week 13 (last week of term) on Monday at 11.30pm. Expect that extensions will not be granted. This is due to NUS grade reporting requirements for modules without a final exam.

Useful References

Lindy Ryan (2018), Visual Data Storytelling with Tableau, Addison-Wesley.

Nathan Yau (2011), Visualize This: The FlowingData Guide to Design, Visualization and Statistics, Wiley.

Cole Nussbaumer Knaflic (2015), Storytelling with Data: A Data Visualization Guide for Business Professionals, Wiley.

Allen B. Downey (2015), Think Stats: Exploratory Data Analysis, 2nd Edition, O'Reilly.

Steve Wexler and Jeffrey Shaffer (2017), The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios, Wiley.

Tentative Schedule

<i>Week</i>	<i>Business Analytics</i>	<i>Visualisation in Tableau</i>
1 11/1 (M)	Introduction to Data Visualisation Review: Pivot Tables and Data Aggregation	Introduction to Tableau Fast Run: Sheets, Dashboards, and Stories
2 18/1 (M)	Visual Encoding of Data Data Aggregation	The Zen of Tableau The Elements of Tableau Getting Data into Tableau Data Preparation Data to Visuals: The Charts of Tableau Level of Detail (LOD) Calculations Table Calculations
3 25/1 (M)	Visual Encoding of Data Data Aggregation	
4 1/2 (M)	Visual Encoding of Data Data Aggregation	
5 8/2 (M)	Exploring Data / Descriptive Analytics in Tableau	
6 15/2 (M)	Midterm (Tuesday; 16 Feb 2021; 6.30pm to 8.00pm; Venue: TBA)	
-	Recess Week	
7 1/3 (M)	Exploring Data / Descriptive Analytics in Tableau	Filters and Parameters Counterfactual Analysis
8 8/3 (M)	Dashboard Development	Dashboards and Stories Cross-Sheet Interactions
9 15/3 (M)	Dashboard Development	A Few More Visuals (Route Visualisation; Geocoding; Measure Names/Values) Organizing and Supplementing Data Sources Outstanding Tableau Content Tableau Exercises
10 22/3 (M)	Visual Design, Communication and Storytelling	
11 29/3 (M)	Visual Design, Communication and Storytelling <i>Due: Visual Analytics Proposal (Friday; 11.30pm)</i>	
12 5/4 (M)	Additional Topics / Potential Guest Lecture	
13 12/4 (M)	Additional Topics / Potential Guest Lecture <i>Due: Final Project Submissions (Monday, 11.30pm)</i>	
-	Reading Week	