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

DSC4215/DOS4811 Data Visualisation

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Session: Academic Year 2021/2022 Semester 1

Course Outline (*correct as at: 18 June 2021*)

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.

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. **Read all text in red before registering.**

Sections and Scheduling

Date/Time: Thurs 6.30pm – 9.30pm (tentatively Face to Face)

Venue: Seminar Room **Frontier**, Level 1, Shaw foundation alumni house

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**

Students may make use of the default 14-day trial first. During these 14 days, students may obtain 1 year student licenses with a student status letter via the link **https://www.tableau.com/academic/students** *Student status letters that indicate the duration of enrolment will be required as supporting material. To obtain such a letter, follow the instructions at* **http://nus.edu.sg/osa/services/student-status-letter.html**

https://kahoot.it/ will be used for recap questions during lecture and contribute to class participation.

We will make heavy use of the integrated instant messaging tool in LumiNUS (Microsoft Teams). The main channel for the class will be **#datavis-aug-2021.** Microsoft Teams 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 this course 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".)

Assessment Breakdown

Class Participation	20%
Individual Assignment	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. Kahoot.it will be used for quick recap simple questions and contribute to class participation.

Introductions (2%). Each student should, by the end of the second week of the semester:

- Join the "Microsoft Teams Team" via this link and join the class channels
- Under Account Settings (click on the ≡ icon to find it) set your full name (per LumiNUS) and append the **last 4 digits plus letter** of your matriculation number, e.g. **John Li (1234X)**; this is crucial to be credited for your participation
- Post a selfie with an introduction in `#datavis-aug-2021`. 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 start forming teams by putting your registered name + last 4 digits plus letter of matric number in each team, e.g. **John Li (1234X)**

Content Sharing (2%). Students should keep a lookout for interesting examples of visualisation in their work or in media, post examples in `#datavis-aug-2021` 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 given" or "no points"). Indicate (i) your full name (per LumiNUS), and (ii) "last 4 digits plus letter" of your matriculation number, e.g. **John Li (1234X)**, to facilitate scoring.

Attendance (6%). By default you are expected to come to face to face lectures, unless the policy requires fully virtual class. When joining the class over Zoom due to valid reasons, such as Stay-Home Notice, please choose your zoom name to include (i) your full name (per LumiNUS), and (ii) "last 4 digits plus letter" of your matriculation number, e.g. **John Li (1234X)**. This facilitates crediting you for participation. Please check item (ii) because that will be what gets scribbled down, and if a match cannot be found, those points will be lost.

https://kahoot.it/ **in-class questions (6%).** During lecture, kahoot will be used to engage the class to recap previous lectures, or recap each segment of the ongoing lecture. The faster you click the right answer on your phone or laptop, the more points you will win.

Q&A (4%). Students should ask questions in the Microsoft Teams channel for the class (`#datavis-aug-2021`) and participation credit will be given to those who regularly help their classmates over Microsoft Teams.

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 Thurs, 30 Sep 2021 (Week 7) at 6.30pm – 8.00pm during lecture hours. 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 Microsoft Teams Team. Feel free to use Microsoft Teams Team 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%)

- Context: You will be given one data set.

- **Task 1: Specific data requests from business will be be provided, such as analyze the seasonality of the sales. You will need to generate visualization that answers these queries as a data analyst and provide your insight.**

- **Task 2:** Your task is to identify one business problem and submit the findings to senior management as a report and get their buy in on your suggested visualization to be embedded into daily operations.
    - **Brainstorm and propose** a realistic and "**narrow**" business problem (or organisational issue); focus on a manageable scope; specify consumers of the proposed "visual report" (not necessarily senior management) and the relevant

decisions they usually make; explain how they can better make those decisions with sensible Tableau visualization
    - **Design Tableau visualization and** implementation that generates visuals to address this business problem (In your submission, show only the relevant Tableau sheets and hide everything else.)

- **Task 3: Draft a report** summarizing the work of task 1 and 2
  Below is for task 2 only
    - Articulate the background and context under the heading "Background" for senior management (use appropriate sub-headings)
    - Introduce how consumer of this report (not necessarily senior management) can make those decisions now based on the Tableau visualization; Provide illustrations of the various use cases in the report (i.e.: clear examples of how decision makers use the visuals to support decision making; the visuals need not be the only input; domain knowledge is a plus)
    - Benefits to the business of the new report
    - Limitations and future work, e.g. relevant data to be collected for further improvement

- **Submission**
    - Submit via LumiNUS ("Individual Assignment" folder):
        - Single ZIP file named in the following format `[Matriculation Number].zip`
        - Include: Report in **PDF format** with length no more than 8 pages (12pt font; single spaced; no annexes, margin 1'' on all 4 sides) including images and charts (Note: Shorter is better. Get to the point. "Bottom Line Up Front")
        - Include: **Tableau file in `twbx` format**; check this; a penalty will be applied if this is not adhered to)
        - Include: transformed data set, if any transformation done to raw data outside of Tableau (You are expected to do data transformation in Tableau as much as possible)
    - The size limit for one file is 500MB in LumiNUS
    - Verify that the submission was successful (e.g.: re-download your submission and open it)
- **Due: Week 10 on Fri, 22 Oct, 2021, at 11.30pm. Do not wait till last minute; late submissions due to Internet problem or technical issues last minute will still incur penalty points.**

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.

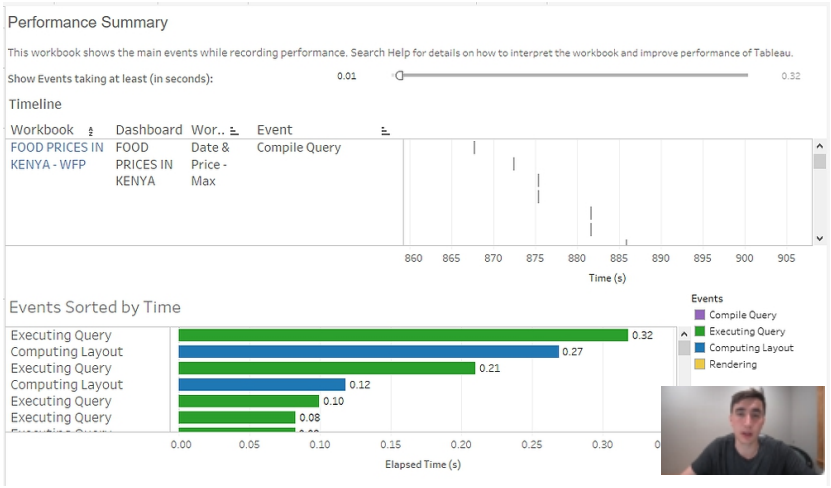
While business problems from companies/non-profits/charities/etc. are more desirable, students are welcome to create "synthetic data sets".

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 Microsoft Teams Team (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 `[Group Name].zip`. Since the size limit for one file is 500MB in LumiNUS, multi-part zip files will be allowed, in which case the names of the files submitted should take the form `[Group Name]-file1.zip, [Group Name]-file2.zip` …

Submissions should contain:

- Overview of video presentation in **PDF format** (a list of: time stamps, current presenter & corresponding topic within a time frame, corresponding page number and paragraph in report); it is recommended to create this as a sketch (storyboard) for your video, and update timestamps after recording your video; this facilitates grading
- A report in **PDF format** with length no more than 16 pages (12pt font; single spaced; no annexes, max margin 1 inch on all 4 sides) including images for the important use cases (Note: Shorter is better. Get to the point. "Bottom Line Up Front")
- The data set
- A presentation deck in **PDF format** (if used in video)
- Dashboards in **`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 name should be introduced in speech or text captions**; **DO NOT READ FROM A SCRIPT.** The preferred format is shown as the below picture (the small frame with the speaker can be in any of the four corners.)



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. The simplest option is to use Zoom for recording.

Submissions are due: Week 13 (last week of term) on Monday, 8 Nov, 2021 at 11.30pm. Do not wait till last minute; late submissions due to Internet problem or technical issues last minute will still incur penalty points.

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

Week	*Date*	*Business Analytics*	*Visualisation in Tableau*
1	12 Aug, 2021	Introduction to Data Visualisation Review: Pivot Tables and Data Aggregation	Introduction to Tableau Fast Run: Sheets, Dashboards, and Stories
2	19 Aug, 2021	Visual Encoding of Data	The Zen of Tableau Getting Data into Tableau; Data Preparation Data to Visuals: The Charts of Tableau Level of Detail (LOD) Calculations Table Calculations
3	26 Aug, 2021	Data Aggregation	
4	2 Sep, 2021	Exploring Data / Descriptive Analytics in Tableau	Descriptive Statistics via the Analytics Pane Order of Operations Filters and Parameters Counterfactual Analysis
5	9 Sep, 2021		
6	16 Sep, 2021	Dashboard Development I	Dashboards and Stories Cross-Sheet Interactions
-		**Recess Week**	
7	30 Sep, 2021	**Midterm: Thurs, 30 Sep 2021, 6.30-8.00pm; Venue: TBA**	
8	7 Oct, 2021	Dashboard Development II	Dashboards and Stories Cross-Sheet Interactions
9	14 Oct, 2021	Visual Design, Communication and Storytelling I	Organizing and Supplementing Data Sources Outstanding Tableau Content Tableau Exercises
10	21 Oct, 2021	Visual Design, Communication and Storytelling II *Due: Individual Assignment (Fri, 22 Oct, 11.30pm)*	
11	28 Oct, 2021	**Tentative: Guest Lectures on Visual Analytics in the Enterprise (Tableau & Holistics)**	
12	4 Nov, 2021	**No class due to Deepavali**	
13	11 Nov, 2021	**Tentative: Guest Lectures on Visual Analytics in the Enterprise (Amazon & Microsoft)** *Due: Final Project (Mon, 8 Nov, 2021, 11.30pm)*	
-		**Reading Week**	