MAT4376G - Introduction to Quantitative Consulting

Course Logistics

Susan Storm: So what are these fundamental principles, if they are not atoms?

Reed Richards: Stories, which give me hope. We are a boatful of monsters and miracles, hoping that, somehow, we can survive a world in which all hands are against us. [...] Yet I posit we are in a universe which favours stories. A universe in which no story can ever truly end; in which there can be only continuances.

(N. Gaiman, Marvel 1602)

Course Description

With solid **analytical** and **abstraction** skills, graduates with a background in mathematics and statistics are in high demand. The gap between theory (or textbook applications) and real-world uses can prove **surprisingly difficult** to navigate, however.

In this **project-based course**, you will

- study a number of quantitative consulting projects and techniques;
- learn about various non-technical aspects of consulting;
- explore the different roles that quantitative consultants play;
- develop the ability to interpret results for, and communicate findings to, clients, and
- apply the course teachings to concrete group consulting projects.

Course Logistics

Instructor: Patrick BOILY

Course Schedule

- TUE 13:00-14:30 | CBY B202
- THU 11:30-13:00 | CBY B202
- OFFICE HOURS: by appointment (ZOOM, SLACK, STEM541)

Course Website

- data-action-lab.com/iqc
- mat4376g-f21.slack.com

Course Evaluation

Presence Building – 10%

- advertise yourself as a freelancer, social media exercise, landing page, blog, CV, etc.
- approach must be approved by Sep-24 – 5%
- execution (ongoing, Dec-17) – 5%

Team Project(s) – 40%

- team meetings and minutes (ongoing); weekly documentation of tasks and time worked (ongoing); ongoing communication – 5%
- outline and workplan – 5% (due by Oct-08)
- progress reports – 5% (Oct-15, Nov-05, Dec-03)
- system and data understanding, data processing and cleaning, data visualization – 5% (due by Nov-19)
- analysis and final report – 15% (on overleaf, due by Dec-19)
- case study write-up – 5% (due by Dec-19)

Course Evaluation

Class Participation – 10%

- attendance, punctuality, staying awake, not on the phone, or surfing the web
- insightful interventions, honest questions, earnest answers

Weekly Tasks – 20%

- about non-technical video lectures and case studies (ongoing)
- will occur during 10 Tuesday sessions (can be done remotely) – 10 x 2%
- you will be given instructions/readings and will have to accomplish a task in a set amount of time

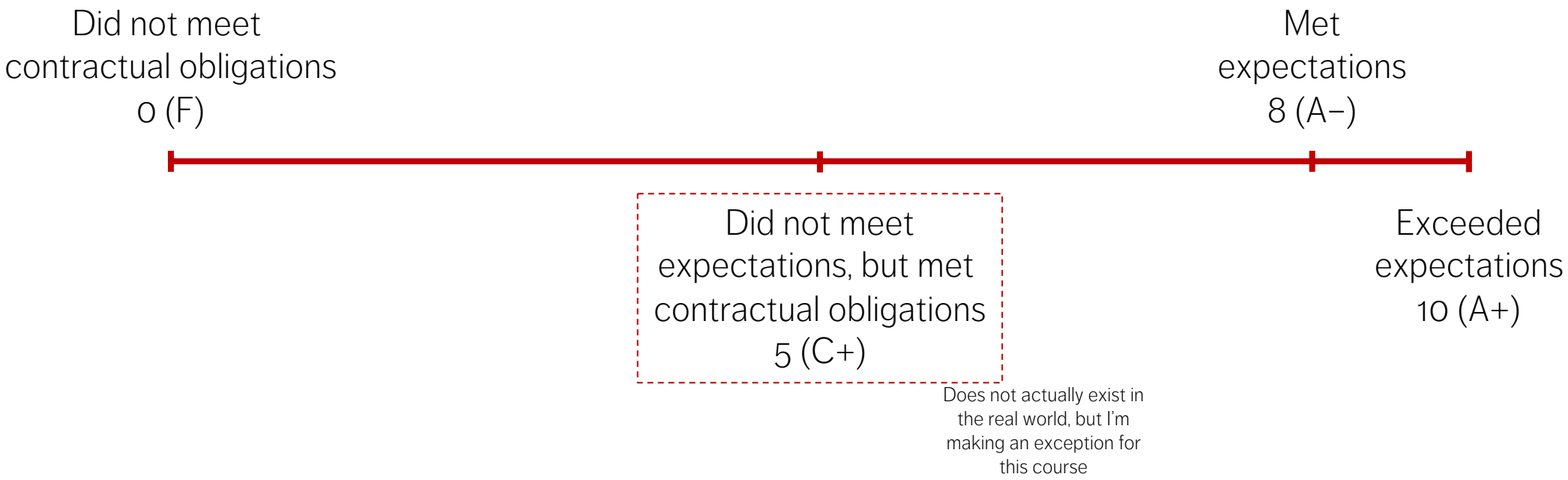
Blog Article – 20%

- choice of topic must be approved by Sep-17 – 5%
- outline due by Oct-01 – 5%
- first draft due by Oct-22 – 5%
- final version due by Nov-12 – 5%

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Videos
01: Sep-06				First Lecture (Sep-09)		ACW: Smit, Victoria
02: Sep-13		Project Topics (Sep-14)		Teams/Project(s) Selection (Sep-16)	Blog Article topic due (Sep-17)	1.1 – 1.8
03: Sep-20		Weekly Task 01 (Sep-21)		Project Work (Sep-23)	Presence building idea due (Sep-24)	ACW: Julie
04: Sep-27		Weekly Task 02 (Sep-28)		Project Work* (Sep-30)	Blog Article outline due (Oct-01)	2.0 – 2.5
05: Oct-04		Weekly Task 03 (Oct-05)		Project Work (Oct-07)	Outline/Workplan (Oct-08)	2.6 – 2.12
06: Oct-11		Weekly Task 04 (Oct-12)		Project Work (Oct-14)	Progress Report #1 (Oct-15)	3.1
07: Oct-18		Weekly Task 05 (Oct-19)		Project Work (Oct-21)	Blog Article first draft due (Oct-22)	ACW: Youssouph
08: Oct-25	*Reading Week*					3.2
09: Nov-01		Weekly Task 06 (Nov-02)		Project Work (Nov-04)	Progress Report #2 (Nov-05)	4.1 - 4.4
10: Nov-08		Weekly Task 07 (Nov-09)		Project Work* (Nov-11)	Blog Article due (Nov-12)	ACW: Ying
11: Nov-15		Weekly Task 08 (Nov-16)		Project Work (Nov-18)	Final Report part 1 (Nov-19)	ACW: Oliver, Jen, Maryam, Doug, Andrew
12: Nov-22		Weekly Task 09 (Nov-23)		Project Work (Nov-25)		
13: Nov-29		Weekly Task 10 (Nov-30)		Project Work (Dec-02)	Progress Report #3 (Dec-03)	
14: Dec-06		Project Work (Dec-07)				
15: Dec-13	Final Presentation, TBD				Presence Building exec due (Dec-17)	Final Report due (Dec-19)

Grading Scale

Every course evaluation item is graded on the **consulting scale**:



Historically: A+ [30%]; A [30%]; A– [30%]; B+ [10%]

"The early stages of education have to include a lot of lies-to-children, because early explanations have to be simple. However, we live in a complex world, and lies-to-children must **eventually be replaced** by more complex stories if they are not to become delayed-action genuine lies."

(T. Pratchett, I. Stewart, J. Cohen, The Science of Discworld)

lies-to-children: "as much as they can understand"
lies-to-bosses: "as much as they need to know"
lies-to-patients: "as much as is required to keep them from worrying"
lies-to-ourselves: ...

Multiple I's Framework

Intuition: understanding the data and the analysis context

Initiative: establishing an analysis plan

Innovation: searching for new ways to obtain results, if required

Interpretability: providing explainable results

Insights: providing actionable results

Integrity: staying true to the analysis objectives and results

Multiple I's Framework

Independence: developing self-learning/self-teaching skills

Interactions: building strong analyses through (often multi-disciplinary) teamwork

Interest: finding and reporting on interesting results

Intangibles: putting a bit of yourself in the results/reports; thinking "outside the box"

Inquisitiveness: not just asking the same questions over again

Mr. Gustave: I'm not angry with Serge. You can't blame someone for their basic lack of moral fiber. He's a frightened little yellow-bellied coward. It's not his fault, is it?

Mustapha Zero: I don't know. It depends.

Mr. Gustave: Well, you can say that about most anything. "It depends." Of course, it depends.

Mustapha Zero: Of course, it depends. Of course, it depends.

Mr. Gustave: Yes, I suppose you're right. Of course, it depends. However, that doesn't mean I won't throttle the little swamp rat.

(The Grand Budapest Hotel, 2014)

Assumptions and Expectations

Time commitment: Consulting is not a spectator sport – I expect that you will spend on average 8-10 hours each week on this course (in the classroom, reading/viewing the course documents, and working on the various projects).

IMPORTANT: I will not be teaching specific quantitative methods. The focus is on project management and pipelines.

COVID-19 pandemic note: obviously, there is a lot of uncertainty and stress associated with the current crisis. I urge you to take any and all reasonable precautions to maximize your health, physical and mental.

Assumptions and Expectations

Pre-requisites:

- multi-variable calculus, lin. alg., probability, statistics, regression analysis, machine learning
- more importantly, the ability to learn new technical topics rapidly, with little guidance
- programming proficiency (R / SAS / Matlab / Python / etc.)

You will be treated as junior consultant trainees in a consulting shop. We will set-up Slack channels for internal communication (preferred option). Emails can be sent to pboily@uottawa.ca if needed.

We meet twice a week during regularly scheduled time (you can attend remotely on Tuesdays). Attendance is **mandatory**, however.

Case Studies

Flight Route Predictive Analytics Model

Demographic Clustering of Canadian Health Regions

Effects of a Probiotic Agent on IBS

Predicting CIS Status

Fluidity Indicators and Seasonality Adjustment

Failure Analysis Simulation Model for Nuclear Waste Repository

Visualization of the Canadian Consular Network Data

Imputation of Blood Alcohol Content in Fatal Collisions

Canadian Vehicle Use Study

Optional Reading

Introduction to Quantitative Consulting

2. Data Preparation
3. Data Visualisation and Representation
4. Statistical Analysis
6. Data Science and Machine Learning
7. Simulations
8. Optimisation
9. Trend Extraction and Forecasting

(IQC documents still at a DRAFT stage)

Data Science Report Series

- Anomaly Detection and Outlier Analysis
- Essentials of Queueing Systems Methods
- A Soft Introduction to Bayesian Data Analysis
- Principles of Data Collection
- A ggplot2 Primer
- Dashboards and Data Visualization, with Examples
- Data Analysis Case Studies
- Feature Selection and Data Reduction