

**SU Disclaimer:** "We may have to revise the course plan according to the reassessment to be made country-wide, regarding higher education, at the beginning of April. The content to be delivered is certain but the method of course delivery, the number and dates of exams, and some other details are subject to change."

**BA in Management Program  
Business Analytics Minor Program  
Spring 2023  
OPIM 407 – Advanced Business Analytics**

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Type	Time	Days	Where
Class	9:40-12:30	Thursdays	SBS G013-14 and Zoom* (via Sabanci User Email)

\* The zoom link for our classes (Meeting ID: 942 4463 2226 Passcode: 441724):  
<https://sabanciuniv.zoom.us/j/94244632226?pwd=am5DbzR2VW4wako4eJlJHQzE4QUVMZz09>

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**Course Description:**

The main objective of this course is to present predictive and prescriptive analytics tools in the context of business cases, with an emphasis on implementing analytical approaches within an organization. Throughout this course, students will learn to use tools and ideas from business analytics and R's environment to solve interesting and exciting business problems; learn how to formulate relevant business questions that can be answered using data; understand the various steps of data preparation like data cleaning and feature extraction; develop and test hypotheses to inform managerial decisions and to collaborate meaningfully with multiple stakeholders; evaluate the effectiveness of a solution through statistical learning methods (supervised & unsupervised methods); communicate results to both technical and non-technical audiences.

**Course Objectives:**

This course builds on the introductory course OPIM 390 Introduction to Business Analytics. It aims to extend the students' background in business analytics by adding new descriptive, predictive and prescriptive tools. It also aims giving the students to opportunity to explore their core business analytics skills and improve them to have a solid foundation. Specifically, at the end of this course, students should develop knowledge and hands-on skills about:

1. In different business contexts, how to formulate relevant business questions that can be answered using data in order to facilitate improved data-driven decision making.
2. Steps involved in different methodological approaches such as CRISP-DM, KDD and SEMMA.
3. Given a business problem, implement and assess the results of the appropriate descriptive predictive or prescriptive methods.

4. Understand the basic concepts, assumptions as well as pros and cons of the newly covered business analytics tools such as collaborative filtering, classification using naïve Bayes, black-box predictive data mining approaches such as neural networks and support vector machine as well as ensembles.
5. Effectively communicate the results of a business analytics project, both orally and in writing.

**Learning Outcomes:**

Upon successful completion of the course, the student should be able to:

1. Select a methodological approach (CRISP-DM, SEMMA or KDD) and give an overview of the steps in a business analytics project,
2. Use descriptive, predictive, and prescriptive analytics methods on business data considering the given decision-making contexts,
3. Analyze a business case, select and apply an appropriate method to reach a business decision,
4. Use at least one leading software package in business analytics.

**Course Material:**

Textbook:

There is no required textbook for this course. The course’s primary material will be slides, and R scripts, which will be posted on SUCourse.

Software:

We will primarily use R & RStudio for business analytics in this course. Students can download and install them on their laptops and/or can sign up and RCloud Studio.

Optional Software:

KNIME (a free open source analytics platform – knime.org), SAS Visual Analytics, RapidMiner (a free open source analytics tool – rapidminer.com), Orange (a free open source analytics platform – orange.biolab.si), IBM SPSS Modeler with Text Analytics, Simio, Weka, Arena and Python.

Case Studies:

Cases are used as real-world examples of the topics. There will be two case analysis reports to be prepared as a team. The teams can consist of up to three students (teams comprised of one student will also be allowed). The teams should work to address the issues raised in the case, clearly identify the problems to be studied, determine, and apply the necessary tools.

The details on the case studies are provided below:

<b>Case 1</b>	<b>Due:</b>	<b>Week 5</b>
	Type:	Harvard Business School Publishing Case – Prepare case report
	Subject:	Descriptive Data Mining: Collaborative Filtering
	Teamwork?:	Yes
	Grading:	Team
<b>Case 2</b>	<b>Due:</b>	<b>Week 9</b>
	Type:	Harvard Business School Publishing Case – Prepare case report
	Subject:	Predictive Data Mining: Neural Networks
	Teamwork?:	Yes
	Grading:	Team

### Reading Assignments:

Several additional articles and cases will be announced weekly or bi-weekly via SUCourse. They will be used as real-world examples of the topics covered in class or to facilitate the development of core business analytics skills.

### Optional Reading Materials:

Several online resources for reviewing the R software are available. Each student should check these resources and find the one that works best for his/her learning. The references include the following and their links will be posted on SUCourse during the semester.

- Grolemund, G. and H. Wickham (2018) *R for Data Science*, O'Reilly.
- Jeffrey, B. A. (2020) *R for Data Science: Exercise Solutions*.
- Wilke, C. O. (2019) *Fundamentals of Data Visualization*, O'Reilly.
- Wickham, H. and J. Bryan (2015) *R Packages*, O'Reilly.
- Silge, J. and D. Robinson (2017) *Text Mining with R: A Tidy Approach*, O'Reilly.
- Wickham, H. (2021) *Mastering Shiny*, O'Reilly.

Additional list of book references includes the following:

- Davenport, T. H. and J. G. Harris (2007) *Competing on Analytics: The New Science of Winning*, Harvard Business Review Press.
- Baesens, B. (2014) *Analytics in a Big Data World: The Essential Guide to Data Science and its Applications*, John Wiley & Sons.
- Dean, J. (2014) *Big Data, Data Mining, and Machine Learning: Value Creation for Business Leaders and Practitioners*, John Wiley & Sons.
- Mayer-Schönberger, V. and K. Cukier (2014) *Big Data: A Revolution That Will Transform How We Live, Work, and Think*, Eamon Dolan/Mariner Books.
- Stubbs, E. (2014) *Big Data, Big Innovation*, John Wiley & Sons.
- Bozkaya, B. and V.K. Singh (2015) *Geo-Intelligence and Visualization through Big Data Trends*, Hershey, PA: IGI Global.
- Witten, I. H., E. Frank, M. A. Hall and C. J. Pal (2016) *Data Mining: Practical Machine Learning Tools and Techniques* (4th Edition), Morgan Kaufmann.
- Sharda, R., D. Delen and E. Turban (2016) *Business Intelligence, Analytics, and Data Science: A Managerial Perspective* (4th Edition), Pearson.
- Berinato, S. (2016) *Good Charts: The HBR Guide to Making Smarter, More Persuasive Data Visualizations*, Harvard Business Review Press.
- Dinov, I. D. (2018) *Data Science and Predictive Analytics*. Cham, Switzerland.
- Agrawal, A., J. Gans and A. Goldfarb (2018) *Prediction Machines: The Simple Economics of Artificial Intelligence*, Harvard Business Review Press.
- Daugherty, P. R., and H. J. Wilson (2018) *Human + Machine: Reimagining Work in the Age of AI*, Harvard Business Review Press.
- Iansiti, M and K. R. Lakhani (2020) *Competing in the Age of AI: Strategy and Leadership When Algorithms and Networks Run the World*, Harvard Business Review Press.

## **Course Web:**

The course syllabus, announcements, (pre-lecture and post-lecture) notes, some in-class exercises and their solutions, and your grades will be posted on SUCourse. Students are expected to visit SUCourse a couple of times each week.

The pre-lecture and after-lecture notes will be posted on SUCourse which will be organized on a week and chapter basis so that students can follow the course schedule posted at the end of this syllabus. The pre-lecture slides include majority of the slides and are posted before the lectures so that students can print them or download them to take they can take notes during the lectures.

The announcements component of SUCourse will be actively used for sharing announcements. Each announcement posted on SUCourse will be emailed to the students, thus the students are responsible for regularly checking their emails and appropriately setting the emailing options in their SUCourse account.

Majority of the in-class exercises will be zoom poll questions that will be responded to in 1-2 minutes depending on the complexity of the question. Remaining in-class exercises are to be downloaded and uploaded via SUCourse's assignment component. Similarly, the case analysis reports, the term project presentations and final reports are to be uploaded under the designated assignment.

For the individual assessments, cases, and term project, the Turnitin tool will be used. Sabanci University uses a very powerful web-based tool called Turnitin. Turnitin is the worldwide standard in online plagiarism prevention. It allows instructors to compare student papers against a database composed of millions of articles. Every paper you submit for the homework assignments, reflection paper, midterm exams, case analysis reports, and term project will be scanned by Turnitin, and results will be reflected in your grades.

## **Instructional Design:**

The course will be taught using a blend of in-class and online synchronous lectures. The course is designed to facilitate active learning of the topics and hands-on learning of the software (mainly R) through in-class exercises, various individual assessments such as homework assignments, quizzes, midterms, and/or reflection papers. There will be two case analysis reports, and a term project (to be prepared in teams of up to three students) and aim to facilitate development of essential skills demanded in the field of business analytics.

The pre-lecture notes will be posted on SUCourse in the main page which will be organized according to the week number and topic name to match the schedule posted at the end of this syllabus. The post-lecture notes prepared for each chapter will be available to the students at the SUCourse site after each topic is completely covered in the lectures.

In-class and online synchronous lectures are also interactive via in-class exercises that are carried out by the students either individually or in groups. The students who are in-class might be required to connect to zoom for the in-class exercises. These assignments involve answering posted zoom poll questions as well as using advanced statistics, spreadsheet modeling, and coding in order to perform the corresponding business analytics tasks.

Some of the in-class exercises done in the lectures might be pop-quizzes which are included in your individual assessment grade. There are currently three individual assessments that are already posted on the schedule (see the last page of this syllabus). Further details regarding the nature of each individual assessments will be posted on SUCourse,

Cases and the term project are used as real-world examples of the business analytics tools covered. The students are asked to submit two case analysis reports in teams consisting of 1-3 students. Similarly, the term project involves a presentation and a final report and can be done in teams of up to three students. The case teams and term project teams can be different, and this decision is at the discretion of each team.

### **Grading:**

Attendance and Participation:	10%
In-Class Exercises:	20%
Case Analysis Reports:	10%
Individual Assessments (Midterm(s), Quizzes, Assignments and/or Reflection Papers):	45%
Term Project (Presentation and Report):	15%

### Peer Evaluation in Teamwork

Students will be asked to provide an evaluation of the members of their team in the cases analysis. Each student will divide 100 points between the members of her team, including him/herself. This division should reflect that person's judgment of the contribution of the members of her team. The scores should not be merely functions of time spent by each member, but they should be measures of the "contribution;" their relative contribution to the idea generation, research, analysis, writing, oral presentation, report writing, etc. If the team was highly functional, and each member did what they committed themselves to, then the student can assign the same mark to each member of the team. If, on the other hand, some members of the team did not fulfill their commitments and did not contribute as much as the others, then points can be distributed unevenly.

The points submitted by all members of the team will be aggregated by the instructor. Every student will be given his/her aggregate peer evaluation, without disclosing the individual peer evaluations to the students.

In case there is no consensus among the team, for example, if three students divide the marks evenly and the fourth one divides them unevenly, then the instructor will use his/her judgment to assign peer evaluation marks--possibly after meeting with the members of the team.

In cases where there are conflicting marks, it is most likely that the instructor will meet with the team members and provide a mark based on an interview. For example, in a group of four, if Students A and B believe they did most of the work, and Students C and D believe otherwise, the team may be called in for an interview in order to be fair to everyone.

Past experience indicates that in most groups points will be distributed evenly. There will be a few groups where peer evaluations will play a role in the marks. The primary goal of this exercise is to avoid giving undeserved credit to individuals who did not help their teams. However, it is possible to have upwards adjustments of marks in case of students who have done more than what the group expected of them.

The peer evaluation will have a direct impact on your case analysis grades. To give a simple example, if the group mark is 20 out of 25, and if your peer evaluation indicates that your contribution was less than what was expected, then your case analysis grade mark will be less than 20 out of 25. There are no simple rules for adjustment.

## **Requirements:**

### Attendance & Participation

Class attendance includes being in the class (physically or through zoom) **on-time in each session, hence, we have a poll for acknowledging your presence at the beginning of each session.** It also includes **getting involved in the learning process** during class hours without distracting yourself or your classmates by various non-class related activities.

Class participation includes getting involved in the learning process during class hours either physically or online. **The non-verbal participation** requires being promptly in class and engagement via complying with classroom policies and conduct (see page 8 of this syllabus). Points can be taken off for not complying with the classroom policies and conduct. **The verbal participation** involves contributing to class discussions positively and regularly and asking questions which cannot be possible without due preparation (hence quality, relevance, frequency, and timing will be accounted for). Reading the material to be covered and working out any problems that are suggested will prepare you for each class session. Hence, last year we have actively used zoom polls and chat to enable active participation of our students.

### In-Class Exercises

In-class exercises will be assigned during class hours. They may be group or individual exercises. These will be completed during class and submitted at the end of the class hour. Still, very few of them might be started in-class and submitted afterward at times to be announced by your instructor. You are expected to work on the assigned exercises by communicating with your classmates and the instructor (through the Zoom Breakout Rooms if required). Although these in-class exercises will be graded, majority of them are not quizzes but means to learn the topics actively during physical and online synchronous class hours. Students who are not present physically or on zoom will not receive grades from such exercises. In the case of glitches preventing the expected presence, students should send a short email and inform the instructor immediately to find a solution.

Some of the in-class exercises might be pop-quizzes that are to be included in your individual assessment grade.

### Individual Assessments

There will be a number of individual assessments in the form of pop-quizzes, midterm(s), reflection papers and/or homework assignments. The individual assessments are not equal weight and the weights will be posted throughout the semester as they are announced and before they are conducted.

Currently dates of three individual assessments are posted on the course schedule (see the last page of the syllabus). Further details of the individual assessments (other than the pop-quizzes) will be posted on SUCourse. The individual assessments in the form of a midterms will comply the rules announced by Sabanci University considering the medium of teaching in Spring 2023. Hence, we need to wait and see the decisions of the Higher Education Council of Turkey as well as Sabanci University.

If you have missed or will miss any individual assessment and you have an approved health report, please get in touch with your instructor immediately to formulate a proper makeup for the missed individual assessment.

## Case Analysis

There will be two case assignments to be prepared as a team consisting of up to three students (see page 2). Students are free to form/change their teams in each case. Each case must show the names of all team members.

The teams should address the issues raised in the case, clearly identify the problems to be studied, determine, and apply the necessary business analytics tools. A case report will be prepared for each case explaining the decision-making problem at hand and the approach taken by the team to address the situation, presenting their analysis and recommendations. Each team should submit their report on SUCourse only once as a PDF file. For the sake of completeness, teams can additionally email their R scripts to the instructor.

## Term Project

The Term Project will be assigned towards the end of the semester. The project can be done in teams of no more than three students. The project will be about a real business case with real data where students will be expected to apply the concepts and techniques learned in class to data-driven decision making. The term project involves a presentation and a final report.

The teams will be expected to **present their term project** in week 13. The PowerPoint slides need to be posted through the designated SUCourse Assignment. The presentation is expected to be 10 minutes long and summarize the progress in the term project.

The **final report of the term project** is due to the first week of university-wide final exams. The final report of the term project must show the names of all team members. The teams should submit their final report through SUCourse only once as a PDF file. For the sake of completeness, teams can additionally email their R scripts or any other source files to the instructor. Project teams who want to use other software than R, should get in touch with the instructor and get consent.

## Late Submission Policy

Late submissions will not be allowed for the in-class exercises and individual assessments. However, for the case analysis reports and term project reports only one-day lateness might be allowed with a lateness penalty of 15-20% (i.e. 15-20 points out of 100 points), which is at the full discretion of the instructor.

## Interviews

As part of the assessment of all course requirements, the faculty member may invite a student or a team for an online interview to go through the solutions and underlying the case report, project report R script files and/or Excel files.

Considering the guidelines provided to the faculty members by Sabanci University, it is at the full discretion of the faculty member to make these interviews or not. The guidelines provided for the interview require the online interview to be recorded.

It is worthwhile to note that students should not feel stressed due to the possibility of the conduct of the interviews as they will be done only on a need basis. Students are expected to check their emails regularly and positively respond to the interview email invitation in a timely manner (within one-two business days is acceptable).

## Academic Honesty:

Learning is enhanced through cooperation, and as such, you are encouraged to work in groups, ask for and give help freely in all appropriate settings. At the same time, as a matter of personal integrity, you should only represent your own work as yours. Any work that is submitted to be evaluated in this class should be an original piece of writing, presenting your ideas in your own words. Everything you borrow from books, articles, or web sites (including those in the syllabus) should be properly cited. Although you are encouraged to discuss your ideas with others (including your friends in the class), it is important that you do not share your writing (slides, MS Excel or R script files, reports, etc.) with anyone. Using ideas, text, and other intellectual property developed by someone else while claiming it is your original work is *plagiarism*. Copying from others or providing answers or information, written or oral, to others is *cheating*. Unauthorized help from another person or having someone else write one's paper or assignment is *collusion*. Cheating, plagiarism, and collusion are serious offenses that could result in an F grade and disciplinary action.

**Specific to this course, it is important to know that submitting a computer file (e.g. Excel workbook or R script file) prepared by someone else, even partially, is cheating.** You may talk to others about assignments, but in the end, you should be doing all the work. It is important that you do not share your solutions as Excel files with anyone until it has been graded. Sharing your file with others could easily tempt them to submit part or all of it as their own. This would be cheating and, in most cases, easy to detect. Once you share your file with someone, it could easily be forwarded to a lot of students and some of whom could cheat or plagiarize. Plagiarism is a very serious misdeed that can result in a reduced grade or an F (for the assignment and/or the course). *Please pay utmost attention to avoid such accusation.*

## Classroom Policies and Conduct:

Sabancı BA in Management Program and Business Analytics Minor Program **value participatory learning**. Establishing the necessary social order for a **participatory learning environment requires that we all:**

- Start each fifty-minute class session on time. This involves coming to each class physically or online on time.
- Turn off all cell phones, tablets, laptops or other electronic devices unless they are used as part of the lecture.
- Do not leave and re-enter the class during each fifty-minute long lecture (of course glitch related exceptions are granted for online students and students in class can silently get the consent of the instructor by showing their eyes for a folded lens emergency and the like).
- Come prepared to make helpful comments and ask questions that facilitate your own understanding and that of your classmates. This requires that you complete the assigned readings for each session before the class starts.

## Office Hours:

Office hours arranged by your instructor and teaching assistant can be **face-to-face or online via zoom or google meet**. Designated office hours will be announced on SUCourse. If they do not work for you, please send an email (at least one day before) to arrange an office hour in a different time.



**Tentative Course Schedule Updated According to New Academic Calendar:**  
**Might be subject to change due to updates of teaching medium in April**

<b>Week 1</b>	<b>Date:</b> <b>March 02, 2023, Thursday</b> <b>Topic:</b> Introduction to the Course <b>Requirements:</b> Install first R and then RStudio; or freely sign up to RStudio Cloud
<b>Week 2</b>	<b>Date:</b> <b>March 09, 2023, Thursday</b> <b>Topic:</b> Review of Data Exploration and Data Visualization in R <b>Requirements:</b> Review Descriptive Statistics and Data Visualization Topics
<b>Week 3</b>	<b>Date:</b> <b>March 16, 2023, Thursday</b> <b>Topic:</b> Descriptive Data Mining: Text Mining <b>Requirements:</b> Read the Posted Reading Assignment <b>Individual Assessment 1:</b> <b>Details will be posted on SUCourse in Week 2</b>
<b>Week 4</b>	<b>Date:</b> <b>March 23, 2023, Thursday</b> <b>Topic:</b> Descriptive Data Mining: Collaborative Filtering <b>Requirements:</b> Review of Descriptive Analytics with Focus on Association Rules Topics
<b>Week 4*</b>	<b>New Date:</b> <b>March 25, 2023, Saturday [Note the class change to SBS 1005]</b> <b>Topic:</b> Optional Predictive Data Mining: Time Series Forecasting in R <b>Requirements:</b> Review Time Series Components Topics
<b>Week 5</b>	<b>Date:</b> <b>March 30, 2023, Thursday</b> <b>Topic:</b> Predictive Data Mining: Performance Evaluation and Model Selection <b>Requirements:</b> Review Linear Regression and Multiple Linear Regression Topics <b>Case 1 Due:</b> <b>Submission of the case analysis report on SUCourse</b>
<b>Week 6</b>	<b>Date:</b> <b>April 6, 2023, Thursday</b> <b>Topic:</b> Predictive Data Mining: Feature Selection <b>Requirements:</b> Review Decision Trees: Classification and Regression Trees Topics <b>Individual Assessment 2:</b> <b>Details will be posted on SUCourse in Week 6</b>
<b>Week 7</b>	<b>Date:</b> <b>April 13, 2023, Thursday</b> <b>Topic:</b> Predictive Data Mining: Neural Networks <b>Requirements:</b> Read the Posted Reading Assignment – A Note on Neural Networks
<b>Week 8</b>	<b>Date:</b> <b>April 20, 2023, Thursday – Spring Break [No Class] ☺</b>
<b>Week 9</b>	<b>Date:</b> <b>April 27, 2023, Thursday</b> <b>Topic:</b> Predictive Data Mining: Support Vector Machine <b>Requirements:</b> Read the Posted Reading Assignment <b>Case 2 Due:</b> <b>Submission of the case analysis report on SUCourse</b>
<b>Week 10</b>	<b>Date:</b> <b>May 04, 2023, Thursday</b> <b>Topic:</b> Predictive Data Mining: Naïve Bayes <b>Requirements:</b> Review Classification and Logistic Regression Topics
<b>Week 11</b>	<b>Date:</b> <b>May 11, 2023, Thursday</b> <b>Topic:</b> Predictive Data Mining: Ensembles and Model Uplifting <b>Requirements:</b> Read the Posted Reading Assignment <b>Individual Assessment 3:</b> <b>Details will be posted on SUCourse in Week 10</b>
<b>Week 12</b>	<b>Date:</b> <b>May 18, 2023, Thursday</b> <b>Topic:</b> Prescriptive Analytics: Discrete Event Simulation <b>Requirements:</b> Work on your term project.
<b>Week 13</b>	<b>Date:</b> <b>May 25, 2023, Thursday</b> <b>Term Project Presentation:</b> Presenting term projects. Details will be posted on SUCourse in Week 12. <b>Submission of presentation file on SUCourse</b>
	<b>Final Exams Week 1:</b> <b>Specific date to be announced.</b> <b>Term Project Report:</b> <b>Submission of the final report of the term project through SUCourse.</b>