

INSTRUCTIONS FOR MBG491 CAPSTONE PROJECT 1 MBG492 CAPSTONE PROJECT 2

Please carefully read the following instructions about the *capstone project* which describe the guidelines about the contents and formats of Capstone Projects 1 & 2.

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1. Group formation

Please notice that this is a **group project**. At the outset, you should form groups of minimum 5 (up to 7) with whom you have common research interests. A group coordinator should be also nominated for each group.

1.1. *List of suggested research areas*

The students will be given a list of projects available to them at the beginning of the semester, with indication to the project advisor and the type of the project (Theoretical / Practical), and will be asked to assign, due time, to the one they select according to their interests. The work will begin after the groups are formed.

Please beware that no changes will be allowed after the deadline for project selection. Those that have not selected a project by the end of the deadline will be placed to suitable projects by the department.

2. Project proposal

This proposal consists of several sections describing the basic aspects of your *capstone project*. The intent of writing this proposal is for you:

- ✓ To learn to articulate a reasonable, doable original research project in the last year of study under Capstone Project 1 and Capstone Project 2.
- ✓ To outline each part of the research necessary for the timely completion of your project.
- ✓ To explain in straightforward language what you will study, what question you want to answer, and/or what problem you want to address.

1.2. *Content*

- I. **Topic on which you want to focus on** (The specific question or hypothesis of your project).
- II. **Practical significance of the project:**

- (a) What is the relationship between your question/hypothesis and the academic study of the problem?
 - (b) Why is it important to the field of study? What original contribution does it make to real-world problems?
- III. **Proposed method of study (How will you do the project? at least one of the following options):**
- (a) Quantitative and Qualitative Analyses
 - (b) Optimization / Operations Research
 - (c) Simulation Modelling
 - (d) Conceptual Modeling
 - (e) Multi-Criteria Decision Analysis
 - (f) Machine Learning / Deep Learning
 - (g) Hybrid Methods
 - (h) ...
- IV. **Proposed method of data collection/organization:**
- (a) How will you gather data/material for your project?
 - (b) What kind of data?
 - (c) How much data – and/or how many participants – do you need for your project to be legitimate?
- V. **Expected accomplishments:**
- (a) What achievements do you expect from your project?
 - (b) How can you implement and realize your main results?
 - (c) How much flexibility can you estimate to extend your achievements in case of any fluctuations in the data or incorporating new assumptions/options for future research?
- VI. **Timeline:**
- (a) How can you define the timeline based on the deadlines given to each section?
(Use a **Gantt chart** as necessary)

3. Capstone Project 1

Here, we will have online courses to learn the fundamental principles on different topics

- Week1: Lifelong learning, access to information, following developments in science and technology
- Week2: Ethical principles and standards used in engineering practices
- Week3: Project management, risk management, change management and applications in business life
- Week4: Entrepreneurship, Innovation and Sustainable development
- Week5 :The effects of engineering practices on health, environment and safety in universal and societal dimensions, Legal implications of engineering solutions

along weekly quizzes for the first five weeks.

Meanwhile, you can proceed with your project when your proposal is approved by your supervisor. In the first part of your project (Semester 7), we seek presenting the problem, related literature and a review of potential methodologies for the research problem at hand. The deliverable items of Capstone Project 1 are shown in Table 1. You are asked to revise them continuously based on the comments and feedback you received from your supervisors, and then, an *interim report* is provided after making final corrections, including sections of *Introduction, Literature Survey and Review of Potential Methodologies*.

3.1. *Data availability*

Data availability issue is one of the most critical steps in the project. You have several options to utilize the data collected from

- a. Secondary data collected from various data sources
- b. Literature review as benchmarks
- c. Or eligible third-party which needs an approval by the supervisor

3.2. *Interim Report for Capstone Project 1*

This interim report will be part of your final report and should include the **corrected** versions of the following sections (based on supervisor feedback):

1. ***Introduction*** (*representing the problem significance and applications*)

- 1.1. *Objectives*
- 1.2. *Questions*
- 1.3. *Contributions*
- 1.4. *Structure of the project*

2. ***Literature survey*** (*creating a comparison table is recommended*)

3. *Review of Potential Methodologies* (*presentation of the proposed methodologies*)

3.1. *Optimization/Simulation/Conceptual Model*

3.2. *Solution Method (If applicable)*

3.3. *Data collection method*

References

4. Capstone Project 2

In the second part of your capstone project (Semester 8), we seek presentation of the data collected and final methodology implementation. Here, you should clearly report the collected data, as well as the implementation and results of the developed methodology. The deliverable of this part is a final report including 4 sections, namely, *Final Methodology*, *Implementation Results*, *Discussion*, and *Conclusion*.

4.1. *Final Report for Capstone Project 2*

In addition to Sections 1-3 from Capstone Project 1:

4. *Final Methodology* (*add an explanation about the final methodology to be used and its technical details*)

5. *Implementation Results*

5.1. *Data/Case*

5.2. *Numerical/Analytical Results*

6. *Discussion & Conclusion* (*practical implications and managerial insights, summary of the main findings, limitations and future research directions*)

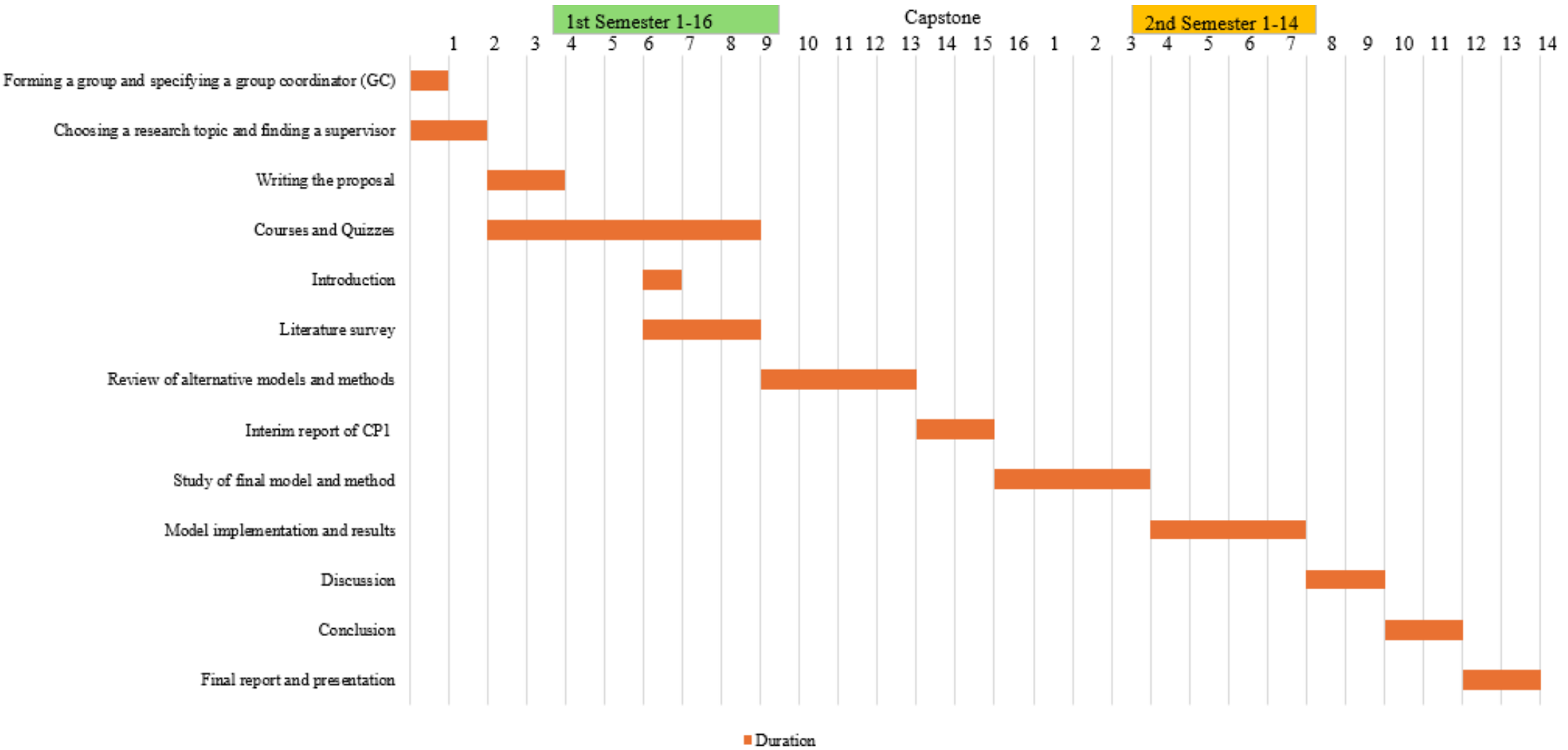
References (*merged with references from Capstone Project 1*)

5. Deadlines

Table 3 displays the proposed deadlines to be carefully taken into account.

Table 1. Important deadlines for Capstone Project 1.

Actions	Deadlines	Deliverable items
Courses and Quizzes	Weeks 3-7 (1st semester)	Records of online courses and quizzes on Blackboard
Assigning to a project, forming a group and specifying a group coordinator (GC)	Week 1-2 (1 st semester)	An email to the Capstone Projects Coordinator by the GC
Writing the proposal	Week 3-5 (1 st semester)	Approved report (with or without modification) by supervisors (upload it)
Introduction	Week 7 (1 st semester)	Approved report (with or without modification) by supervisors (upload it)
Literature survey or Experimental model	Week 10 (1 st semester)	Approved report (with or without modification) by supervisors (upload it)
Review of alternative models and methods	Week 14 (1 st semester)	Approved report (with or without modification) by supervisors (upload it)
Interim report of CP1	Week 16 (1 st semester)	Interim report (upload it)
Poster presentations by each groups	Week 16 (1 st semester)	
Study of final model and method	Week 4 (2 nd semester)	Approved report (with or without modification) by supervisors (upload it)
Model implementation and results	Week 8 (2 nd semester)	Approved report (with or without modification) by supervisors (upload it)
Discussion	Week 10 (2 nd semester)	Approved report (with or without modification) by supervisors (upload it)
Conclusion	Week 12 (2 nd semester)	Approved report (with or without modification) (upload it)
Final report and presentation	Week 14 (2 nd semester)	Approved report (with or without modification) by supervisors (upload it)



6. Grading

Timely delivery of each section is highly appreciated. Missing each section will affect the remaining sections. Please be careful about the timeline to prevent losing grades. In the following, Tables 2 and 3 respectively show the grading procedure of Capstone Projects 1 & 2 which are defined based on *content quality, correctness, writing/English* and *timely delivery*.

Table 2. Grading of capstone project 1.

Deliverable	Grade
Quizzes	25
Proposal	15
Introduction section (Chapter 1)	15
Literature review & Methodology section (Chapter 2 & 3)	25
Attendance (At least %80)	10
Quality of interim report (based on the template)	10

Table 3. Grading of capstone project 2.

Deliverable	Grade
Methodology section	15
Implementation and Results section	20
Discussion & Conclusion section	20
Discussion & Conclusion section	20
Attendance (At least %80)	10
Presentation and Jury Evaluation	25

Please be informed that a **grading policy** will be adopted along with jury (3 faculty members) grading to calculate your *final grade*. In particular, your project should meet the standards given in the capstone guidelines document.

6.1. *General grading criteria for each deliverable item: Capstone project 1*

✚ **Quizzes**

- ✓ Grades obtained from the online exams.

✚ **Project Proposal**

- ✓ Are research problem and main idea clearly defined?
- ✓ Are the objectives clear and non-imaginary?
- ✓ How is the quality of writing with respect to the guidelines and English?

✚ **Introduction section**

- ✓ Is background information given?
- ✓ Is the significance of the problem explained?
- ✓ Is the problem stated clearly?
- ✓ Are the research objectives and possible contributions clearly defined?

✚ **Literature review section**

- ✓ At least 25 high-quality papers must be reviewed from international journals indexed in Scopus and/or WoS, and cited in the report.
- ✓ How relevant are the reviewed papers?
- ✓ A comparison of the literature (tabular form is recommended)
- ✓ How well the gaps are found and discussed?

✚ **Methodology section (sub-section 1: review of possible methodologies)**

- ✓ Are the potential methodologies clearly discussed and compared?
- ✓ Are the data requirements and data acquisition methods defined clearly?
- ✓ Has the choice of methodology been discussed and justified?

✚ **Interim Report**

- ✓ Are the corrections thoroughly made based on the comments?
- ✓ Is the report in compliance with the writing format?
- ✓ Is the similarity score on Turnitin less than 30%?
- ✓ Is the report according to the timeline suggested in the proposal?
- ✓ Is there any significant deviation from the objectives?
- ✓ Are there any inevitable changes to the timeline or project plan affecting the remaining steps?
- ✓ What are the major research outcomes achieved so far?
- ✓ How is the writing quality of interim report?

- ✓ Are the references in the interim report correctly cited using citation tools such as Mendeley and Zotero?

6.2. *General grading criteria for each deliverable item: Capstone project 2*

✚ **Methodology section (sub-section 2: methodology/-ies used in the project)**

- ✓ Is the research problem and proposed methodology (research framework) well-illustrated?
- ✓ Are the implementation steps explained in detail?
- ✓ Is(are) the data collection technique(s) clearly discussed?
- ✓ Is(are) the data analysis method(s) delineated?
- ✓ How are the evaluation and justification of the methodological choices you make (criteria you use)?

✚ **Results section**

- ✓ Are the quantitative research results reported using tables, charts, etc.?
- ✓ How well significant and interesting findings are described in conjunction with each illustration?
- ✓ Comparative and sensitivity analyses are recommended.

✚ **Discussion & conclusion section**

- ✓ Are the key findings discussed properly without missing any specific parts?
- ✓ Are the theoretical and operational limitations of the project and results explained?
- ✓ Are the theoretical and practical implications elaborated?
- ✓ Is the reader reminded of the main research question of the project in a clear way?
- ✓ Is the research project well-summarized with respect to its main sections?
- ✓ Is the key finding of the project highlighted clearly?
- ✓ Are the recommendations for future study given based on the limitations?

7. Writing format

This section gives the required details about the standards to write your proposal and reports.

7.1. *Writing format of the proposal*

Please follow the format given below to prepare a project proposal:

Cover page...

Abstract...

- 1. Problem Statement...**
- 2. Background...**
- 3. Project Goals and Objectives...**
- 4. Methods...**
- 5. Expected Outcomes...**
- 6. Timeline...**

Appendix (if needed)

References...

Moreover, the *cover page format* of the proposal can be found in the **Proposal Template**.

7.2. *Writing format of the final report*

When you are done with this section, the final report should be prepared in six main sections based on the following format:

Cover page

Abstract (summarizes the project w.r.t. its significance, contributions and achievements)

Table of Contents

List of Tables

List of Figures

List of Abbreviations

- 1. Introduction...**
- 2. Literature review...**
- 3. Methodology...**
- 4. Results...**
- 5. Discussion and Conclusion**

Acknowledgement

Appendices

References

Based on the writing format described below, your final report should be restricted to 50 pages (excluding cover page, acknowledgement, references and appendices).

Moreover, the *cover page format* of the final report can be found in the **Final Report Template**.

7.3. *General rules for writing*

❖ **Abstract and keywords**

The abstract should be at least 150 words. The abstract should consist of a single paragraph. The maximum numbers of keywords are 5.

❖ **Length of paper and margins**

In formatting your A4-size paper, the top, bottom, left and right margins should be set to 1 inch.

❖ **Font specification and spacing**

The “main body” of the paper should be set in the Times New Roman font using a 12-point font size. Please set 1 inch margin from left, right, top and bottom.

The report should be with 1.5 lines spacing. Use 11-point Times New Roman for the “abstract” and “keywords”.

❖ **Figures and tables**

Figures and tables should be centered within the text and should not extend beyond the right and left margins of the paper. Figures and tables are numbered sequentially, but separately. All tables and figures should be explicitly referenced in the text and they should not be placed before they are referenced.

Use 11 point Times New Roman for the “contents of the tables and figures” and also use 11 points (bold) Times New Roman for the “captions of the tables and figures”. Each figure should appear in the text after the paragraph in which the figure is first referenced.

Figure 1 is an example that authors may find useful. Table 1 in Subsection 1.2 is also a useful example of the tables.

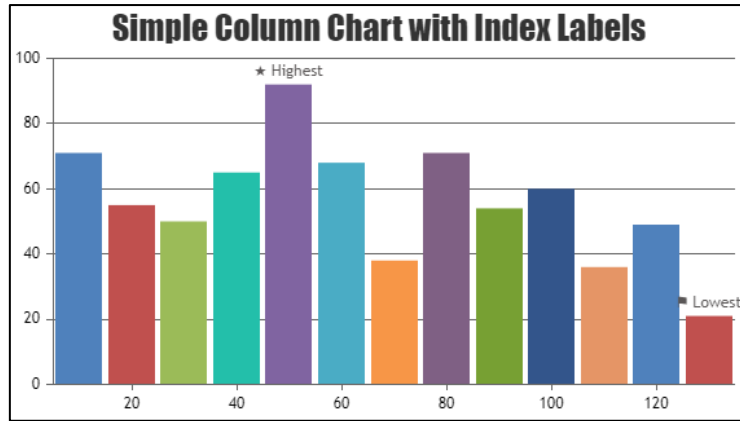


Fig. 1. Obtained results of the study.

❖ Equations and formulas

Equations and formulae should be typed and numbered consecutively with Arabic numerals in parentheses on the right hand side of the page (if referred to explicitly in the text),

$$w = \frac{x_1 + 3x_2}{y^2(1 - k)}. \quad (1)$$

❖ Acknowledgment

Place the acknowledgments section, if needed, after the main text, but before any appendices and references. The section heading is not numbered.

❖ Appendix

Place any appendices after the References and label them A, B, C, and so forth.

❖ References

Your references should be published materials accessible to the public. “References” should be set in *APA format* and the Times New Roman font using an **11-point font size**.

Place the list of references after the appendices. The section heading is “References”, and is not numbered. List only references that are cited in the text. Arrange the references in alphabetical order. This reference section must be properly created by citation tools such as Mendeley and Zotero.

Journals:

Chaturvedi, S., Rajasekar, E., & Natarajan, S. (2020). *Multi-objective building design optimization under operational uncertainties using the NSGA II algorithm*. Buildings, 10(5), 88.

Books or conferences:

Jensen, P. A., & Bard, J. F. (2002). *Operations research models and methods*. John Wiley & Sons.

Radivojević, G., & Milosavljević, L. (2019). *The concept of logistics 4.0*. In 4th Logistics International Conference, 23-25.

Web references:

Wikipedia, "Bee". Available at <https://en.wikipedia.org/wiki/Bee>. [Accessed on February 21, 2016].