



# SYSTEM DESIGN

## IE 477 - IE 478

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### *Course Coordinators:*

Dr. Savaş Dayanık

Dr. Nesim K. Erkip

Dr. Emre Uzun

### *University-Industry Collaboration Projects Coordinator:*

Yeşim Gülseren

### *Assistants:*

Tolunay Alankaya

Aslı Erođlu

İsmail Burak Taş

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# Characteristics

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- Project-based and Problem Solving
- Synthesis – Capstone Project
  - Oral and Written Communication
  - Team work
- Two semesters, but you will receive a grade at the end of each semester



# Industrial Project

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- To solve a real-life problem and implement proposed solutions
- Subject committee (academic advisor, industrial advisor, teaching assistant, course coordinators, interested faculty members)
- Company pays the transportation and some other expenses
- Reports and Presentations
- May require a number of site visits
  - Leave a few half-days for group meetings and potential company visits if requested



# Industrial Project

## A typical text book explanation

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- The following steps may be taken:
  - Study/analyze the system to understand the problem
  - Formulate the problem and define scope of the project
  - Literature Review
  - Develop models
  - Implement the models using appropriate software or your own codes
  - Validate the model and test your results
  - Implement the proposed system/prepare manual



# Learning Outcomes

(May 2021 presentation – M.S. Aktürk)

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- Analyze system data to identify problems
- Know how to access information and do literature survey
- Formulate problems and propose solution methodologies
- Construct mathematical models of the system and validate based on actual data
- Effectively use teamwork (+Peer Evaluation)
- Prepare reports and presentations to explain ideas
- Practice professional and ethical responsibility



# IE 478 Assessment Criteria-1

(May 2021 presentation – M.S. Aktürk)

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- **System design:**

- Model development and validation: The proposed model can be an optimization, statistical, database, marketing or simulation model
- Consideration of alternatives: Extent to which the team demonstrated critical thinking in the design process
- Scenario/ what if analysis: Model usage for changing environments
- Creativity: Extent to which the team developed a novel solution to the design problem while still achieving a functional design
- Technical competencies: Extent to which and validity of the technical aspects have been used properly, including methods, tools and techniques



# IE 478 Assessment Criteria-2

(May 2021 presentation – M.S. Aktürk)

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- **Success of the design:**

- Attainment of project deliverables: Extent to which the goals of the project and end-user specifications have been met
  - Benchmarking: A comparison of the current and proposed system should be provided along with a cost/benefit analysis
  - Implementation and system integration: Extent to which the proposed system is successfully implemented and integrated into the existing system – if not applicable, then a detailed implementation plan and a pilot study is to be provided)
  - End-user evaluation and assessment: A written statement from the industrial advisor(s) evaluating the project
  - Impact on the organization: Affect of the proposed system on the organization (financial impact, simplified operations, etc) – in terms of performance measure(s) used in validation
  - Global and societal impact: As an additional consideration
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# Explanations – IE CAPSTONE-1

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- Currently, your strength is “engineering education”
    - Engineer – numbers, facts, abstraction, measurement
  - Your current background – All required courses are finished + electives + current courses
    - Any diversion from above requires more effort
  - Time to devote to the project > 3 credit course
    - Too much course load is not desired
  - Capstone – Bring together all your previous knowledge + methods of inquiries + critical thinking + ability to learn and apply + .....
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# Explanations – IE CAPSTONE-2

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- IE Capstone Project – more specifically
    - Prerequisites: IE303, IE325, IE375 and others
    - Text Books for all courses – First thing to read
    - ~ 60 % of the your work can be handled
    - References in the text book – a good start to go further
  - Get support + advice from current TA's of other courses – Source: Course web pages
  - **Designing a system means a preparation to repeatedly implement the proposed approach over time, under almost all conditions**
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# Roles in Teamwork

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- Natural Roles:
    - LEADER – Contact person is not necessarily the leader
    - CONSENSUS BUILDER
  - All in the group should share the following roles:
    - CONTRIBUTOR
    - PROBLEM SOLVER
    - ASSIST
    - Natural roles (LEADER, CONSENSUS BUILDER) should occasionally be shared as well – last year as a student.
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# Ethical and Professional Responsibility

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- Projects are important for the reputation of Bilkent IE Department – value of your diploma
    - Companies are your potential employers or partners in the future
  - Ethical and Professional Responsibility:
    - Your **commitment** to signed agreements – non-disclosure of data, information + any additional requirements by the company
    - Your **responsibility** to carry-out oral and written promises made
    - Your manner and behavior while communicating within the group, with advisors and coordinators, etc – be formal
    - Any information source or material from literature should be cited
    - Technical results should be clear and reproducible
  - Any violation by any group will affect all of us, our reputation and value of your Bilkent University diploma
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# Project Teams

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- Different Skills
  - Think about roles
  - At least 2 members good in programming
  - Others?
- Presentation skills
  - English/Turkish (At least 2 members able to present in Turkish)
- Good to have a car owner (or better still, two) 😊



# Companies





# Workshops/Seminars

## Fall Semester

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- Capstone Project - How to approach?
- Managing the Budget
- TÜBİTAK Funding
  
- Project Management
- Presentation Techniques
- Team Work and Communication



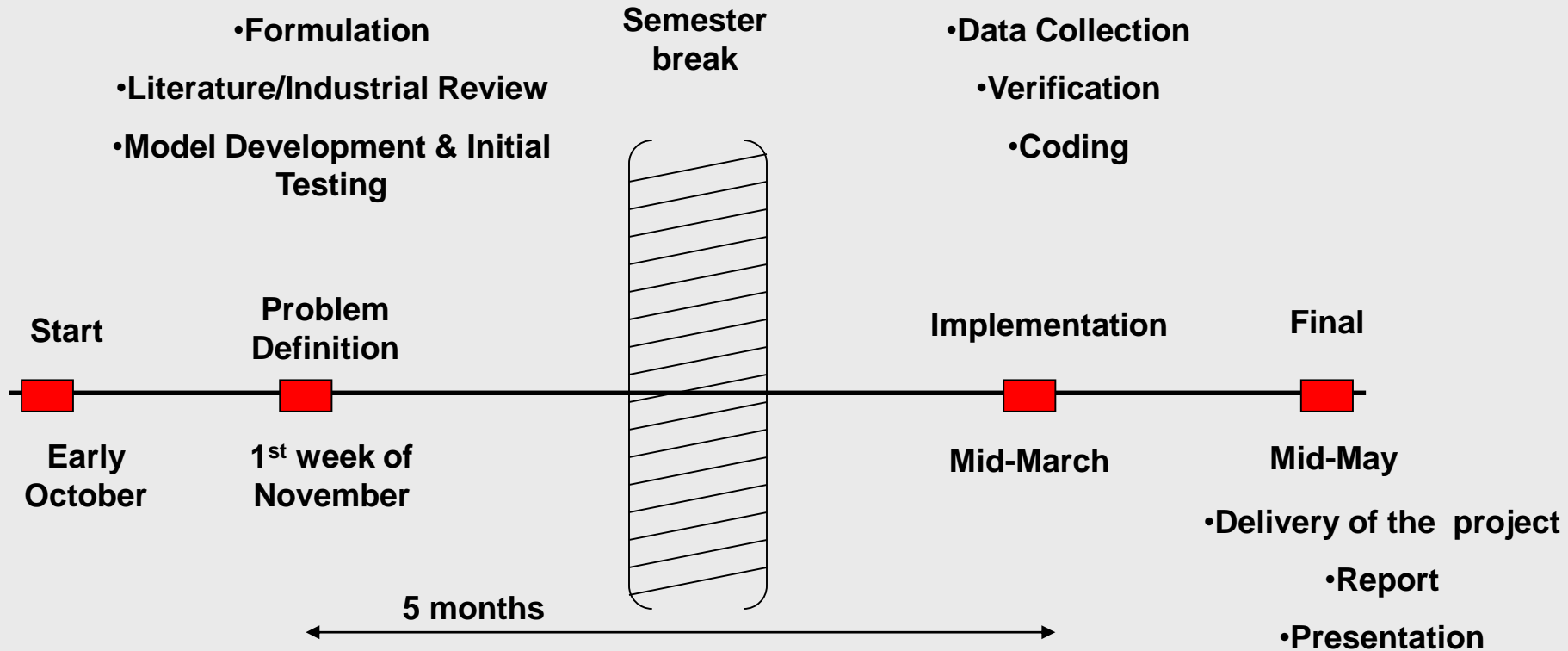
# Effective Project Management

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- ***Project Plan***
  - Tasks, packages, sub-packages, etc.
- ***Time plan***
  - Deadlines, due dates, deliverables
- ***Resource Allocation***
  - Team work
- ***Coordination***



# The System







# Requirements

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- Kick-off Meeting **Early to Mid October**
- Project Proposal Report **Late October to Early November**
- Project Proposal Meeting and Presentation **Early to Mid November**
- First Meeting with Course Coordinators **Nov 26 – Nov 29**
- First Progress Report **Report Due December 27**
- Second Meeting with Course Coordinators **Mid January**
- Second Progress Report **Mid March**
- Project Progress Meeting and Presentation **Mid to Late March**
- Third Meeting with Course Coordinators **Early April**
- Final Report **Mid May**
- Fourth Meeting with Course Coordinators **Late May**



# Project Proposal (Late Oct to Early Nov)

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- Complaints and symptoms from the company
- Required outcomes, expectations: **Deliverables**
- Project constraints and limitations



**Definition and Scope of the Problem - CONSENSUS**  
**!!Go beyond the initial description!!**  
**Main project activities: Workpackages, Timetable**

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# First Meeting with Course Coordinators (Nov 26 - 29)

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- You will prepare a presentation video and upload it by Nov 23
  - A short version of the proposal presentation to course coordinators
- In the meeting you will be asked questions about the project and your proposal
  - To enable coordination between projects



# First Progress Report and Second Meeting with CC

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- Brief definition of the Problem
- Literature Review
  - Previous studies in the scientific literature
  - Similar Studies in the industry
- Proposed Methodolgy
- Model Development and Testing
- Timetable
- For the meeting, you will prepare a presentation video and upload it by Jan 11



# Important

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- All documents related to reports, meetings and presentations are available on the course web page.
  - You are advised to take a look at these documents well in advance to plan ahead.



# Important

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- You will find a report template on course web site.
  - We will use the  $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$  template for all reports



# Important

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- Attendance to all of the workshops and seminars is obligatory from the beginning of the semester!
- Check our web-site frequently.  
[courses.ie.bilkent.edu.tr/ie477](http://courses.ie.bilkent.edu.tr/ie477)
- PUNCTUALITY IS VERY IMPORTANT
  - **Submit all of your requirements on time.**
  - Be ready for any meeting at least 10 minutes before the scheduled time.



# Important

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- No excuse for any part time job you may have.
  - You have to perform all of your duties that are assigned to you in your group.
  - You have to attend all meetings with your advisors and coordinators!





# Team Formation

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- For information on team dynamics follow announcements on <https://courses.ie.bilkent.edu.tr/ie477>
- For each team, fill out the “Team Information Form” via the link sent to you online **until 17:00 TODAY!**
  - Names, e-mail addresses, elective courses, summer trainings, strongest and weakest skills.
  - **ONE SUBMISSION PER GROUP.**
- Each team should have a project contact person
- **Students with no groups:**
  - Inform TAs via [ie477@ie.bilkent.edu.tr](mailto:ie477@ie.bilkent.edu.tr)



# Project Assignments

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- Projects will be announced by early next week.
- Each team is going to send their rankings of the projects and a single page cover letter until **September 30 Thursday by 17:00**
- Fill the required online form (to be provided on the course web page.)



# Project Assignments

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- Goal: Given a set of preferences by student groups and projects, design an assignment process.
- Stable Matching Problem - 2012 Nobel Prize in Economics: Shapley and Roth  
[http://www.nobelprize.org/nobel\\_prizes/economic-sciences/laureates/2012/](http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2012/)
- D. Gale and L. S. Shapley, “College Admissions and the Stability of Marriage”, *The American Mathematical Monthly*, 69, 1 (1962), pp. 9-15



# Project Assignments

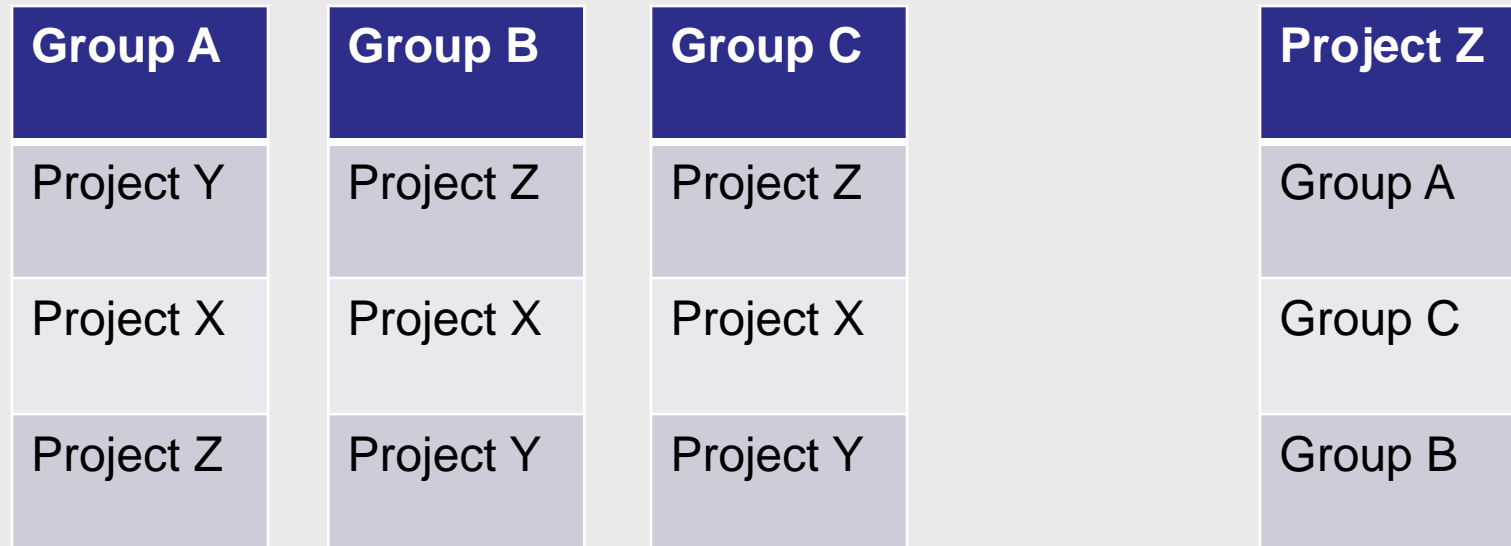
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- Groups:
  - Rank all projects based on how much you wish to get assigned.
- Projects:
  - Rank all groups (information form)
- Basis is the same as the original algorithm. However, we may consider additional constraints imposed by the companies (such as at most one project), as well as others.
- Applied to assign projects to groups in the last five years.



# Example

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# Writing Principles

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- Please state your **team number**, **project title**, **names of the team members** (always in alphabetical order of the last names), **academic and industrial advisors** in all of the written documents that you submit.



# Upload / Naming Principles

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- You will upload a lot of documents to the links provided.
  - Your file names must contain your 4-5 character project short-code along with its purpose:
    - Example from previous years:
      - Arçelik Bolu Pişirici Cihazlar Fab: ARBOL
      - BSH Ev Aletleri: BSHE
      - ETİ Talep Tahmin: ETIT
      - DHL Depo İyileştirme: DHLD
    - File name could be: ARBOL-ProposalReport
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# Assessment

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- Project proposal presentation
- Project proposal report
- Short presentation to Coordinators
- End of semester presentation
- End of semester report
- Academic Advisor evaluation
- Industry Advisor evaluation
- Peer evaluation

*An individual letter grade at the end of each semester*





# Grade

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- If we observe that you have not accomplished the goals to be reached by the end of this semester, you may receive an I (Incomplete) as a group!
  - If you do not complete the missing work within the time limit, this grade will be replaced with an F



# Effect of Peer Evaluation

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Grup AA	Student A	Student B	Student C	Student D	Student E	Student F	Student G	AVG.
Student A		5	5	5	5	5	5	5.00
Student B	5		5	5	5	5	5	5.00
Student C	5	5		5	5	5	5	5.00
Student D	5	5	5		5	5	5	5.00
Student E	5	5	5	5		5	5	5.00
Student F	5	5	5	5	5		5	5.00
Student G	5	5	5	5	5	5		5.00

STUDENT F: We are the winners



# Effect of Peer Evaluation

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<b>Grup BB</b>	<b>Student A</b>	<b>Student B</b>	<b>Student C</b>	<b>Student D</b>	<b>Student E</b>	<b>Student F</b>	<b>Student G</b>	<b>AVG.</b>
<b>Student A</b>		1	5	2	5	5	3	3.50
<b>Student B</b>	1		1	4	1	1	3	1.83
<b>Student C</b>	5	2		2	5	5	3	3.67
<b>Student D</b>	1	5	1		3	2	5	2.83
<b>Student E</b>	1	3	3	3		5	3	3.00
<b>Student F</b>	2	3	3	4	5		3	3.33
<b>Student G</b>	1	5	1	4	1	1		2.17





# Effect of Peer Evaluation

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**ÖZET**

Öğrencilerin akademik başarıları ile ilgili yapılan araştırmaların sonuçları, öğrencilerin akademik başarılarının, öğretmenlerin ve öğrencilerin birbirlerini değerlendirme süreçleri ile ilişkili olduğunu göstermektedir. Bu araştırmada, öğrencilerin birbirlerini değerlendirme süreçlerinin, öğrencilerin akademik başarılarına etkisi araştırılmıştır. Araştırma, öğrencilerin birbirlerini değerlendirme süreçlerinin, öğrencilerin akademik başarılarına etkisini incelemek için yapılmıştır. Araştırma, öğrencilerin birbirlerini değerlendirme süreçlerinin, öğrencilerin akademik başarılarına etkisini incelemek için yapılmıştır. Araştırma, öğrencilerin birbirlerini değerlendirme süreçlerinin, öğrencilerin akademik başarılarına etkisini incelemek için yapılmıştır.

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# Important Dates

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- **September 22 Wednesday, until 17:00** - Reporting team members.
  - Submit the filled “Team Information Form”.
  - Students with no groups inform TA.
- **September 30 Thursday until 17:00** - Ranking industrial project preferences along with a cover letter. Group time schedule.
- **October 5** – Announcement of the Project assignments.
- **October 6 – October 22** – Kick-off Meetings
- **28 days after your Kick-Off** – Project Proposals Due (inc. Saturday & Sunday)
- **November 1 – November 19** – Proposal Meetings
- **November 26 – November 29** – First meeting with course coordinators
- **December 27** – First progress report submission
- **January 17, 18** – Second meeting with course coordinators



# Yeşim Gülseren

Bilkent TTO

Üniversite-Sanayi İşbirliği Koordinatörü

## Destek Verilen Çalışmalar

- İş Dünyası ile iletişim
- Projelere Hazırlık ve Bilgilendirme
- Proje Yönetimi, Koordinasyon
- Projelerin mali, idari ve yasal süreçleri
- İç İletişim ve Motivasyon
- Seyahat Organizasyonu
- Fuar, Kitap ve etkinlik Organizasyonu
- Kariyer Planlama
- Girişimcilik
- Sektör Tanıtım Etkinlikleri



**Rektörlük Binası 3. Kat**

**No : 308**

[yesime@bilkent.edu.tr](mailto:yesime@bilkent.edu.tr)



# Industrial Project

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- INFORMS Undergraduate Operations Research Prize ?
- YA/EM Öğrenci Proje Yarışması ?
- TÜBİTAK 2241-A Sanayi Odaklı Lisans Bitirme Tezi Destekleme Programı ?





# Industrial Project

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- We are planning to organize
  - 20<sup>th</sup> Industrial Engineering Project Fair and Competition
  - Industrial Projects 2022 Book



# Projeler Kitabı





# Endüstri Mühendisliği Bölümü

## Proje Fuarı ve Yarışması

