

**INDR 422 (01) DATA SCIENCE FOR OPERATIONAL DECISIONS**

Spring 2023

**1. Course Information**

<b>Instructor:</b>	Fikri Karaesmen, fkaraesmen@ku.edu.tr
<b>KU Credits:</b>	3.00
<b>ECTS Credits:</b>	6.00
<b>Prerequisite(s):</b>	Prerequisite: COMP 125 and ENGR 200 or Consent of the Instructor
<b>Class Location &amp; Meeting Times:</b>	CASE B24 - Tuesday, Thursday 16:00-17:10
<b>PS (Yes/No):</b>	No
<b>DS (Yes/No):</b>	No
<b>Lab (Yes/No):</b>	No
<b>Language of Instruction:</b>	English
<b>Office Hours:</b>	TBA
<b>Teaching Assistant(s):</b>	

	<b>E-Mail</b>	<b>Phone</b>	<b>Office - Office Hours</b>
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**2. Course Description**

Prescriptive analytics for demand forecasting, time series and regression-based methods, non-linear methods in regression, big data and regularization, predictive analytics, inventory control, data-based inventory control, single-period inventory control with big data and extensions, dynamic programming and reinforcement learning-based approximations in pricing and revenue management.

**3. Course Overview**

This course is an introduction to data science and prescriptive analytics in the context of operations. We take as examples typical operational problems of demand and sales forecasting, inventory management and pricing and revenue management. We review predictive analytics approaches from machine learning and statistics in the context of time-series forecasting and feature-based prediction. We then investigate prescriptive analytics approaches focusing on data-driven optimization and joint estimation and optimization.

We will work with real data as much as possible and the implementations will be in Python.

**4. Course Learning Outcomes (CLOs):**

<b>CLO #</b>	<b>Upon successful completion of this course, students will be able to...</b>
1	use tools of predictive analytics for time series demand modeling and optimization
2	understand and apply the concepts of model validation
3	understand the data driven optimization framework for inventory and price optimization

4	combine and use predictive analytics tools for solving optimization problems from operations
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## 5. Assessment Methods

Method	Description	Weight %
Midterm Exam	Midterm Exam	20.00
Project	Course Project (Groups of 2 or 3)	25.00
Homework	4 Homework Assignments	25.00
Participation	Lecture attendance, in-class exercises, discussion	5.00
Final Exam	Final Exam	25.00
<b>Total:</b>		100.00

## 6. Instructional Material and Learning Resources

- An Introduction to Statistical Learning
  - Author:** G. James, D. Witten, T. Hastie
  - Publisher:** Springer (Year: 2015)
  - Material Type:** Reference Material
  - Material Status:** Recommended
- Active Use of Course Page on Blackboard: <https://ku.blackboard.com/>
- KOLT Tutoring: No Service Available

## 7. Course Schedule

Meeting Times	Subject
WEEK 1	Time series and ARIMA Forecasting, Estimation issues.
WEEK 2	Simple Regression based methods and tradeoffs
WEEK 3	Multi-feature regression and bias/variance tradeoff
WEEK 4	Regularization: ridge and lasso regression
WEEK 5	Advanced regression based methods: non-linear approaches
WEEK 6	Advanced non-linear methods:
WEEK 7	Single-period random demand inventory problem and optimization perspectives
WEEK 8	Joint Estimation and Optimization Framework: modeling extensions
WEEK 9	Capacity Allocation for Revenue Management: Finite Horizon Discrete Time Stochastic Dynamic Programming
WEEK 10	The reinforcement learning framework
WEEK 11	Reinforcement learning and capacity allocation
WEEK 12	Single Item Dynamic Pricing: Stochastic Dynamic Programming formulation.
WEEK 13	Reinforcement learning and dynamic pricing
WEEK 14	Reinforcement learning and dynamic pricing

## 8. Student Code of Conduct and Academic Grievance Procedure

[Student Code of Conduct](#)

[Statement on Academic Honesty with Emphasis on Plagiarism](#)

[Academic Grievance Procedure](#)

## **9. Course Policies**

Honesty and trust are important to all of us as individuals. Copying from others or providing answers or information, written or oral, to others is cheating. Copying from another student's paper or from another text without written acknowledgment is plagiarism. Unauthorized help from another person or having someone else write one's paper or assignment is collusion. Cheating, plagiarism, and collusion are serious offenses resulting in disciplinary action.

## **10. Other**

Please note that due to unusual circumstances this semester, the schedule and the grading scheme are subject to change. Please follow instructions on blackboard.

Participation assessment: The participation expectations (physical vs. online attendance) are also subject to change pending Higher Education Council Decisions. For the online part of the course (for now until the end of March), full participation grades are based on live on line attendance and participation to zoom lectures and zoom polls and other online in-class activities. The logs are taken automatically from zoom/panopto. Please let me know if you have an exceptional situation.