Title	Short Description	Supervisor	Requirements	Assigned ?
Minimum Spanning Tree Problem with Conflicts	A variant of the ordinary minimum spnanning tree problem, the Minimum Spanning Tree Problem with Conflict Constraints (MSTC) will be considered in this project. A conflict constraint states that a certain pair of edges cannot be contained simultaneously in a feasible solution. It is convenient to represent these conflict constraints in terms of the so-called conflict graph whose vertices correspond to the edges of the underlying graph, and whose edges represent conflict relations. Then, every stable set of the conflict graph is a conflict-free subset of edges. Hence, MSTC becomes the determination of a stable set of the conflict graph whose elements represent a connected acyclic and spanning subgraph of the original graph with minimum total weight. The goal of this project is to formulate MSTC, and develop and implement solution procedures. (3-4 students)	Altınel		No
Organizational risk on social networks	[Consult the supervisor for further information]	Aras		No
Müşteri siparişlerinin depo-nakliye planlaması ve organizasyonu	[Consult the supervisor for further information]	Aras		No

Modeling the pharmacodynamics of doping drugs and analysis of anti-doping tests	One of the major problems in sports is the use doping or performance enhancing drugs (PED's) by athletes. To combat the doping problem, various tests are used by anti-doping agencies worldwide. Doping and anti-doping efforts essentially constitute a multi-billion-dollar business worldwide. Anti-doping testing is a very complex process for two main reasons: i- there are too many PED's to test and new ones are constantly being discovered, ii- even for a given PED type, testing and reaching a conclusion can be very complicated due to two opposing and important test errors: false negative (failing to signal doping for an athlete who actually used a PED), and false positive (signaling doping for an athlete who did not use a banned PED, but used some other drug or substance that may produce similar, misleading test results). There is thus a constant effort worldwide to improve ant-doping tests in order to prevent doping, but also protect athletes' rights. One scientific aspect of anti-doping testing is related to the dynamics of a given PED (pharmacodynamics) in the human body. Since a typical doping test involves testing for the PED in urine or blood sample, it is important to know the pharmacodynamics of the given PED, together with popular but unbanned drugs/substances that may yield false positive results. The purpose of this project is to contribute in this direction. The pharmacodynamics of a given popular class of PED (such as Steroids, Testosterone, HGH, Erythropoietin, Ephedrine, Albuterol, Diuretics) will be modeled first. Then the pharmacodynamics of some similar but non-banned drugs or substances will be modeled. Simulated tests will be implemented in different scenarios to investigate the power of basic urine or blood tests in catching doping, as well as false negative results and false positive results. Finally, another complexity is that athletes can simultaneously take some 'legal' drugs (such as Diuretics) that can mask traces of used PED's	Barlas & Yaşarcan		Yes

Interactive dynamic 'diving simulator' to train novice scuba divers	In scuba diving, the body is subject to several forces, some of which being non-linear and delayed. Thus, smooth scuba diving and stabilization is not trivial, which can be risky for the diver. The most essential factor in this process is the force exerted by the jacket (buoyancy compensator), so the diver regulates buoyancy by deflating air from or inflating air into the jacket. The basic forces and feedbacks involved in this process have already been modeled in a M.S. thesis by Evrim Dalkıran (2006) and a simple interactive simulator was built. The purpose of this new project is to extend this prior work in two directions: i- to include and model other realistic factors and forces, such as the hand and fin movements of the diver, position and other diver characteristics, ii- to create a more realistic and richer scuba diving game, by using more advanced software, preferably with extensive web-based and animation features. Firstly the original model will be improved, then the interactive game will be built using this improved model, and finally the game will be thoroughly tested by players. The ultimate purpose is to develop a 'diving' simulator to help diving schools/clubs in training novice divers. The project will involve substantial amount of system dynamics simulation and general computer programming.	Barlas & Yücel		No
Algorithmic trading strategies for cryptocurrency markets	[Consult the supervisor for further information]	Baydoğan		Yes

Real-Time Quality Assurance with Computer Vision in a Robotic Assembly Cell	Industry 4.0 describes the era where digital technologies are used to transform manufacturing into fully integrated automated facilities that communicate with one another and boost flexibility, speed, productivity and quality. Robots have long been used in manufacturing to tackle repetitive, hard or dangerous assignments, but within this new concept they are evolving for even greater utility by becoming more cooperative. In this project, the real-time control software in a robotic assembly cell will be redesigned and implemented such that real-time inspection is integrated with the process in the cell. By achieving cooperation between a robot and a computer vision system, flaws will be detected before the assembly is completed and corrective action will be taken within the same cell based on real-time decision making. The hardware and software in the BUFAIM Lab will be used in the project. Students will first analyze the current system in the BUFAIM Model Factory and come up with a new design for the particular automated assembly processes. Next, computer vision techniques will be used to implement a system for detecting flaws. Finally, communication between the assembly robot, the computer vision system and the cell controller will be achieved. (2-3 students)	Bilge & Baydoğan		No
Designing Inventory Drivers for the Iran Supply Chain of an FMCG Company	[Consult the supervisor for further information]	Bilgiç		Yes
Perishable Inventory Management at a Pharmaceutical Distributor	Pharmaceutical products have limited shelf life, have patents that protect them, have prices strictly regulated by the government. Their inventory management is a challenging task. In this project, you are going to work with an international pharmaceutical company's main distribution center. You will analyze the pharma supply chain, and develop inventory replenishment and rationing rules to satisfy the demand from local pharmacies (2-3 students)	Bilgiç		No

On-line frequency assignment	We focus on the online version of the frequency allocation problem which find applications in wireless communication networks used mainly in military operations. In such problems, a sequence σ of calls of different durations arrive over time. We have $\sigma = (C_1, C_2, \ldots, C_k, \ldots)$ where C_k represents the kth call. Each call C_k must be assigned upon its arrival, without information about future calls $\{C_i \mid i > k\}$, a frequency $A(C_k) \in Z^+$ where $Z^+ = \{1, 2, \ldots\}$. $A(C_k)$ must be chosen among available frequencies, that is, a frequency different from those of other calls in the same cell or neighboring cells, i.e., $A(C_k) \neq A(C_i)$, where $i < k$ and C_i is adjacent to C_k or the same as C_k. The integer frequency once assigned to a call cannot be changed during the survival of this call. Students will firstly explore the notion of online algorithms and competitivity analysis. Then, a literature review on frequency allocation problems with an emphasis on online problems will be carried out. Students are expected to develop new online algorithms for frequency assignment and to test their performances empirically on randomly generated instances. (2-3 students)	Ekim Aşıcı		No

Routing incoming calls in a network	In a communication center, each incoming call has to be routed by a router into one of the trunks the related router is linked to. This pair of router and trunk remains busy during the related call and thus none of them can be used to ensure another communication in this period. We say that the network is saturated if no new call can be routed. We note that this undesired situation corresponds to an inclusion-wise maximal matching in the bipartite graph representing routers, trunks and possible links between them. A maximum matching corresponds to the best case where the network ensures as many calls as its capacity allows to, whereas, the minimum size of a maximal matching reflects the worst case behavior of the system, that is, the minimum number of calls that can saturate the system. The aim of the project is to design heuristic algorithms to route the calls in such a way that the system is not saturated, whenever it is possible. Students will simulate the behavior of such a center under randomly generated calls. First a simplified offline version will be investigated; here the input will be the set of incoming calls where all have the same duration and start at the same time. Then online versions where calls of various durations occur over time will be considered. Students are also expected to make a literature review covering the links of this problem with the minimum maximal matching problem and equimatchable graphs. (2 students)	Ekim Aşıcı		No
Productivity and safety improvement of a work system	Application of ergonomics and other industrial engineering principles at the workplace enhances productivity, quality, and safety and health. This project involves application of these principles in the evaluation and redesign of a selected work system. Project consists of three main parts: (1) data gathering for identification of productivity, safety and health issues, (2) solving the identified issues, and (3) cost-benefit analysis.	Ekşioğlu	A basic course in ergonomics	No
An ergonomics human factors related project of choice of the students	[Consult the supervisor for further information]	Ekşioğlu	A basic course in ergonomics	No
Design of an Index-tracking Optimal Portfolio	The aim of the project is the design of a system which will produce a portfolio mimicking the behavior of a given market index based on various similarity measures to be proposed by the students.	Güllü		Yes

Option pricing of electricity products	In this project the objective is to design a computational modul which enables EneriSa to evaluate the fair value of various energy (particularly electricity) contingent derivatives. The students should be comfortable with coding using R.	Güllü		No
Simulation of disease spread using stochastic SIR models	In the project, simulation will be used to quantify how desease intervention measurments like vaccination, use of antiviral drugs and school closure can help to reduce the impact of a pandemic outbreak of influenza. In a first step the implementation of SIR model simulations for different levels of population contact informations has to be done. These codes will the be used to obtain simulation results that help to asses the advantage of different desease intervention strategies. The main sections of the final report will inculde a presentation of the simulation results and a detailed documentation of the newly developed R-library. Literature: Dimitrov, Meyers (Tutorial Informs 2010): Mathematical approaches to infectious disease prediction and control (pp. 1-8) Longini, Halloran, Nizam, Yang (American Journal of Epidemiology 2004): Containing Pandemic Influenza with Antiviral Agents The pdf-files of the two references can be requested by e-mail from Wolfgang Hörmann or Zeynep Gökce Yildiz.	Hörmann	Knowledge of R and Simulation; interest to learn R programming for simulation	No
Development of a Vendor Managed Inventory Control Mechanism for a Major Cosmetics Supplier	An international cosmetics manufacturer is considering to install a vendor managed inventory control system. To this end the existing supplier - retailer relation is to be analyzed. Order flow rates, transportation and distribution capacities will be determined. Then a new inventory control mechanism that considers predetermined service levels will be developed. The potential impact of the proposed model will be measured and documented.	Korugan		No

Power demand forecasting for a group of energy-intensive industrial facilities	Electricity demand for a group of twenty energy-intensive industrial facilities producing cement and iron & steel will be provided on an hourly basis for a full year. Various time-series models shall be developed in this project to be compared in performance with a modified moving average forecasting method that is currently under implementation by the Turkish Electricity Transmission Company TEİAŞ. The set of industrial facilities that features load shedding for a given threshold value will be studied based on plant-wise load curtailability data (2-4 students)	Kumbaroğlu & Or		No
A Consumer Products Company Product Distribution Route Plan Optimization	The company distributes products to its customers according to a "route plan" – customers have designated day(s) in a week to order and receive products. This route plan evolves frequently due to changing customer orders (in terms of number and quantity). In this system, truck utilization (and related delivery costs) and customer satisfaction (in terms of on time deliveries) are critical both for the company and also for its customers. Accordingly, "Route Plan Optimization", giving consideration to the following factors, is desired: distribution cost limitations, truck utilisation improvement, customers' GR timing limitations at their warehouses, customers' order patterns, local traffic restrictions, miscellaneous route/customer specific exceptions (2-3 students)	Or		No
Optimization of energy generation in hydroelectric power plants	The project group will work with Enerjisa to analyze dynamics of energy generation in hydroelectric power plants from an optimization point of view. Energy generation capability of hydroelectric power plants depend on various factors such as the number of turbines operated and depth of water in the reservoir. Factors such as nonlinearity, fluctuating electricity prices and interactions between multiple hydroelectric power plants along the same river basin further complicate the problem. The aim of the project is to design an optimization-based system to ensure efficient management of natural and company resources. (2-3 students)	Taşkın		No

Modeling The Change of the State Variables	In most dynamic models, the stocks (i.e., the state variables) of the model either change continuously or discretely in time. Therefore, all flows in the model are calculated either discretely, once every time unit (i.e., Time Step = 1 unit time), or continuously (Time Step < 1 unit time, which is an approximation for continuous change). In some cases, a model with some flows changing continuously and some flows changing discretely would have more power in representing a real life problem compared to models that have flows of only a single type. In such cases, if the model is also allowed to have some flows changing discretely, but with a different period than the time unit of the model, the model would be even more realistic. The team is supposed to find good example dynamic problems that must be represented with a model that has mixed-time flows. (2-3 students)	Yaşarcan		
Modelling energy-use behavior of BU students based on personal and climatic conditions	In the course of the "Green Campus" perspective, some of the dormitories of the Kilyos Campus are equipped with advanced monitoring devices that record the heat and electricity consumption in student rooms. The aim of this project is to analyze the data recorded so far in order to develop a behavioral energy consumption model that captures the behavior of the BU students, and helps to identify principal social and/or climatic factors that infleunce the energy-use behavior remarkably (3-4 students).	Yücel		Yes
Simulation-based evaluation of vendor-managed inventory approach for a FMCG supply chain	Currently, distributors of a FMCG company manage their inventories individually by placing weekly orders according to their needs and sell-in targets to the central manufacturing facility. Company is considering to shift to an alternative supply chain-wide stock management scheme; i.e. "Vendor Managed Inventory" model. In this model, the producer will be making replenishment decision centrally for all distributors in-line with their sell-out performance and agreed stock level. In this project, the team is expected to conduct a simulation-based analysis on the pros/cons of such a shift for the performance of the whole supply chain. The team will be using empirical demand and replenishement data of a real-scale supply chain for the past year. (3-4 students)	Yücel		Yes

Re-designing the facility layout for an assemble-to-order production plant	In the context of this project, the project team is expected to analyze the workflow and product routes and to develop inter-departmental flows for current operation of Nova Plastik in its Vize plant. Additionally, the team is expected to gather qualitative data about the interdependency and relationship among different departments. Combining the quantitative flow data and qualitative relationship data, the team is expected to develop layout alternatives for the company's new plant. The proposed designs are expected to primarily minimise the total material flow within the facility, with the secondary goal of minimising the total space used. The analysis will be based on real-life data provided by Nova Plastik. The team will also be required to collect additional data that may be required to supplement the available data from the company. (3-4 students)	Yücel		No