**AØO01: Egendefinert studentprosjekt**

Studenter som finner et prosjekt selv og deretter finner en faglærer som vil veilede det egendefinerte prosjektet, bruker tittelen over for å angi et slikt valg i det webbaserte valgskjemaet. Avtale med veileder må være gjort før valget gjøres på web. Veileders navn må stå i kommentarfeltet i webskjemaet.

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**AØO08: Communicable diseases outbreak control in developing countries**

Many developing countries lack the financial means to facilitate their population with basic sanitation infrastructure or health care provisions. In such countries, the World Health Organization and others have to step in when there is an outbreak of communicable diseases such as Cholera, Typhoid or Ebola. Although much work has been done on emergency preparedness in general, and also on epidemiological modeling of disease spreading patterns, no models exist to support decision making to control such outbreaks.

**Activities**: You will develop an optimization model for decision support in communicable diseases outbreak control. This can be a tactical or an operational model, or both. At the tactical level, given available resources, population densities, seasonal outbreak patterns, and other relevant input parameters an optimal allocation of personal, transportation means, vaccine stocks, etc. will be designed. At the operational level, given an outbreak situation, a distribution plan will be made. How should available resources (helicopters, personal, vaccines, …) be used to minimize damage to the population?

This work will be connected to project acquisition activities targeting the Norwegian Research Council Program for Global Health and Vaccination Research (GLOBVAC)

**Keywords**: Stochastic mixed-integer programming, disease outbreak control, emergency vaccination campaigns

**Partner**: SINTEF Technology and Society

**Supervisors**: Ruud Egging, Post doc. Anders Gulhav and Lars Hellemo (SINTEF)

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**AØO11: Optimizing the troops-to-tasks problem in military operations planning**

The Norwegian Defence Research Establishment (FFI) has primary responsibility for defence-related research in Norway. It is the chief advisor on defence-related science and technology to the Norwegian Ministry of Defence (MoD) and to the Norwegian Armed Forces.

The troops-to-tasks analysis is an essential part of military operations planning. In the troops-to-tasks analysis, the planners examine who should do what, where and when, in a military operation. The operation can be viewed as a project where different resources must process a set of tasks in several locations. Thus, the troops-to-tasks problem is in fact a project scheduling problem, closely related to the well-studied ResourceConstrained Project Scheduling Problem (RCPSP), but with many complicating additions.

In the Norwegian Armed Forces, the Nato organization, and other military organizations around the world, the troops-to-tasks analysis is done manually today. A tool for solving this problem using optimization is lacking. If such a tool were available to military planners, the impact on both the planning process and the final operational plan would be significant. FFI has made some efforts to study different approaches for solving the troops-to-tasks problem using optimization techniques. In this project thesis, some of the relevant topics are:

* ‐ Study recent approaches for solving resource-constrained project scheduling problems.
* ‐ Develop a new mathematical optimization model for solving the troops-to-tasks problem.
* ‐ Study the potential and limits of solving the troops-to-tasks problem using exact optimization approaches.
* ‐ Develop heuristic approaches for solving larger instances of the troops-to-tasks problem.
* ‐ Examine whether uncertainty can be included in the optimization of the troops-totasks problem.

**Collaborator**: Forsvarets Forskningsinstitutt (Maria Fauske)

**Supervisors**: Kjetil Fagerholt, Henrik Andersson, Magnus Stålhane, Post doc. Xin Wang and/or Peter Schütz

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**AØO19: Retail Supply Chain Management**

Grocery retailing constitute a significant part of the Norwegian economy, accounting for 415 billion NOK and involving more than 100.000 employees. They produce, distribute and deliver essential food products to the consumer market, as well as to professional actors in hotels, restaurants, cantinas, etc. In Norway operating these supply chains is particularly challenging due to the topography and the widely scattered population, considered that a high and increasing share of the products are fresh with a short shelf life.

Over the past decades, actors in grocery supply chains have fundamentally restructured and industrialized their operations. Investments in systems and infrastructure, technology and competence have enabled companies to become highly competitive through effective and efficient production and logistics systems. The main strategy has been to restructure production facilities, warehouses, distribution centers and shops into high volume, centralized systems based on principles of scale economics and low unit cost. Demand of food varies highly, throughout the day, week, month, and is strongly affected by seasons, promotions and campaigns and launching of new products. Thus, the order pattern and size is fragmented, and it is challenging to operate an efficient and effective distribution and transport system in the supply chain. Even if strong tools for routing and distribution planning exist retailers and transport providers finds it challenging to plan and manage transport resources in an environment characterized by high variability.

The problem is related to planning models and decision support for transport and distribution in grocery supply chains.

The assignment is related to the Retail Supply Chain 2020 project (RSC2020) which is a 4 year research project finance by Norwegian research council, Coop Norge Handel, Tine, Sunndals potet, Fosen Transport, SINTEF and NTNU. The assignment will be in collaboration with Coop and Fosen Transport.

For further information about the assignment, please contact the teacher. The assignment can be adjusted accorded to the students’ interest and specialization.

**Practicality**: Several student projects can be formulated in the RSC2020 project, and teams of two students can work together within a defined topic. The assignment will be connected to a company and travel expenses will be paid by the project. The assignment can be combined with a research assistance position. The assignment is well suited for extension to a master project.

**Supervisors**: Henrik Andersson, Heidi Dreyer, and/or Peter Schütz

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**AØO23: Optimizing the decommissioning of oil and gas infrastructure**

The recent Paris agreement suggests a roadmap towards a low-carbon economy, implying a shift from fossil fuels to sustainable energy sources. Independent from the question when this will happen, we know that in time, an increasing number of oil and gas fields will be shut down.

The last stage in an oil or gas field’s life cycle is called decommissioning. It is the process of deciding how to shut down operations at the end of a field’s life, plugging the wells, cleaning up, making the installations safe, removing the facilities and reusing or disposing them. The phases of decommissioning are interlinked, such that the platform removal start date can be affected by the timing of well plugging and abandonment (P&A) and pipeline disconnection.

Over the next decade across the UK and Norwegian Continental Shelf:

* ‐ More than 100 platforms are forecast for complete or partial removal.
* ‐ Over 1,800 wells are forecast for P&A.
* ‐ Close to 7,500 kilometres of pipeline are lined up for decommissioning.

This all shows that decommissioning is a growing and relevant market. In recent and ongoing work, we have developed an optimization model for the planning of P&A campaigns. This student project will focus on removal operations within decommissioning. The project will therefore include the following parts:

* ‐ Investigation of the problem
* ‐ Review of scientific literature for similar problems
* ‐ Development of an optimization model based on mixed integer programming
* ‐ Consideration of uncertain factors and how they can be included in the model

This project will be linked to a research council project in cooperation between NTNU, SINTEF and a number of companies in the oil industry.

**Partner**: SINTEF Technology and Society

**Supervisors**: Asgeir Tomasgard and PhD student Steffen Bakker