1 Guidelines

The goal of the assignments is to study a topic on the basis of literature survey and all pertaining information regarding theoretical work or real applications. The documents surveyed may be published state of the art papers on the topic or relevant works corresponding to specific models, solution techniques or applications. The focus should be on quantitative works based on operations research or simulation techniques or possibly other decision making techniques.

The following are general guidelines that might be adapted to the specificity of the topic or during the work progress.

The students will write a paper in English on the topic by December 5th, 2007 and give an oral presentation during the week of December 10th – 15th, 2007 on the basis of a slide presentation (PPT or similar). Documents may be written in Word or LATEX and should be submitted via email as PDF document and in the source format (*.tex, *.doc or *.ppt).

The papers must typically cover the following parts:

- An introductory description of the topic emphasizing theoretical interest and practical applications
- a survey of published literature in the area in the form of a ”state of the art” (this part may be ordered according to the types of applications, models, or solution techniques) and include a synthesis of current status of the topic and directions for further research or applications
- a description of one or several significant work in the area including a problem description, model, solution technique, experimentation (from theoretical data or real application) and conclusions
- a general conclusion summarizing the current status of the topics and personal suggestions for further research and conditions of real applications.
• A reference list written with the usual standards references all documents (papers or other sources quoted in the text. An English translation must be indicated for the titles of documents in another language).

The students’ papers must constitute an original work and writing of the students, inspired by the literature findings and including personal comments, suggestions as well as possible criticisms. Quotations copied from the surveyed papers must be short and limited and clearly indicated by quotes "..." or other marks. It is permitted, however, to copy and paste mathematical models, arrays and figures from the original document on a limited basis, provided the appropriate source quotations are indicated.

A planning of the work to be done will be established at the beginning of the project and followed up during work progress.

The evaluation of the work will consider both the quality and relevancy of the results and findings, and the quality of the written paper and oral presentation and discussion.

2 List of Topics

1. Hierarchical planning of logistic systems or supply chain (strategic, tactical and operational planning); focus on consistency and coordination between levels.

Logistic systems or supply chain networks comprise several levels of entities for procurement, production, storage and distribution of products. Their planning and optimization are typically decomposed into a hierarchical process including a strategic level (long term planning) focused on facility location, a tactical level (medium term) focused on multiperiodic flow optimization and operational level (short term planning) for specific problems such as production planning, inventory management, transport planning. A key factor is the coordination and consistency of planning between levels. The work will focus on the hierarchical planning process and models for joint coordinated planning between two or more levels (ie strategic / tactical or tactical/operational).

2. Supply chain network design and facility location (plants, warehouses..) (complex multilevel supply chains involving complex products and production systems)

Complex supply chains comprise several levels of entities (suppliers, producers, warehouse, clients) and various modes of transport between entities. They deal with complex products described by a bill of material. Models may be static or dynamic (on or several planning periods. The goal of the project is to determine a state of the art in this area and investigate some generic applications or applications in one specific context or economic sector (such as aeronautics, consumer products).

3. Demand management and network optimization in complex supply chains.

Complex supply chains involve production and transport activities from several levels of suppliers and subcontractors to end of line producers and distributors. In order to plan the operations efficiently through the network and over time, end line distributors or producers develop constantly updated demand forecasts and sliding multiperiodic procurement and production / distribution plans for their operations and for an efficient coordination with subcontractors at the upper levels of the supply chain. The goal of the project is to produce a state of the art survey of such
problems and focus on specific areas of applications such as the consumer goods distribution sector, and aeronautic sectors.

4. **Complex transport networks design and optimization (for multimodal transport)**

Complex freight transport network involve several modes of transport and transshipment points involving goods or container handling activities (example: for rail/road or surface / maritime transport). The development of efficient transport networks is a key goal in the European Union policy. The design and optimization of transport networks involve problems such as the location of transshipment points in the network, the choice of transport modes and the optimization of flows through the network. The goal of the project is to determine a state of the art of problems and methods in this area and focus on one specific application such as maritime/surface network, rail/road networks or inland navigation networks.

5. **Network optimization and operational problems for reverse / closed loop logistics**

Reverse or closed loop logistics, is concerned with the handling of classical forward flows (from production to markets) and reverse flows of products sent back into the system (products returned by the consumer, products to be repaired, raw materials to be recycled). The goal of the project is to update a state of the art survey of such problems and focus on specific areas of applications.

6. **Hub location in transport planning : application to different transport modes and systems**

In the airline sector, companies build their network around major airports called hubs. They operate high traffic lines between hubs and secondary lines between hubs and minor airports. Other applications exist for other transport systems. The goal of the project is to make a state of the art of hub location problems and models and focus on models for specific areas such as the design of less than truck load systems for road freight transport systems.

7. **Inventory - routing problems (vendor managed distribution)**

In areas such as petroleum or liquid gas distribution, producers or vendors have to organize multiperiodic routing problems on several days in order to deliver products to consumers and manage their inventory of products to avoid stock outs. The goal of the project is to make a state of the art of problems and models in this area and focus on a specific type of application.

8. **Location routing problems**

Usually, facility (warehouse) location problems are dealt with at the strategic stage of network design, while distribution or routing problems are handled at the operational level. However in important cases, the number and location of facilities influence the routing policy and performance (example when warehouse are only rented and can rapidly change to adjust to the changes in consumer demands and vehicle routing needs). The goal of the project is to make a state of the art of problems and models in this area and focus on a specific type of application.

9. **Optimization of maritime terminal operations:**

    ship loading/unloading, handling or transport equipment scheduling, container storage and moves, . . . . The development of maritime transport is a key issue for the European Union. This requires efficient operations of port terminals, especially for
container movements, handling equipment scheduling or transport vehicles routing. New concepts in maritime transport also emerge, such as motorways of the Sea. The goal of the project is to make a state of the art of problems and models in this area and focus on a specific type of application such as motorways of the sea.

10. **Pick up and delivery routing problems for freight or passenger transport.**
Pick up and delivery routing problems arise when goods or persons have to be picked up at some point in the network and delivered at another point and time (examples: the handling of express freight in cities, or the transport of personnel between oil platforms, or disabled persons transport). The goal of the project is to make a state of the art of problems and models in this area and focus on a specific type of applications.

11. **Logistic optimization problems in the service sector**
(example: field force -technicians routing- optimization for utilities -energy, water distribution -, waste collection. Field force routing and scheduling is a new area in logistics where firms have to plan the schedules and routes to industrial facilities or customer homes for commercial or maintenance operations over a multiperiodic horizon. Schedules and routes have also to be updated in real time to cope for emergency demands during the day. The goal of the project is to make a state of the art of problems and models in this area and focus on a specific type of applications.

12. **Logistic optimization problems in the sector of services to persons**
(ambulance routing, pick up and delivery routing of disabled persons, dial a ride problems, scheduling and routing of nurses to elderly or disabled persons, transportation of disabled persons between homes and schools or work centers). The activities of services to elderly or disabled persons are an area of growing interests for society. The goal of the project is to make a state of the art of problems and models in this area and focus on a specific type of applications.

13. **Real time vehicle routing problems and robust optimization in vehicle routing.**
With the constant growth of consumer demands for improved services and the development of technologies such as GPS vehicle positioning, PDA’s for personals, there is a growing need for real time optimization in routing activities. The goal of the project is to investigate the concepts of robust and real time routing problems and to focus on some specific problems or areas of application.