ÖREBRO UNIVERSITET

Course syllabus
Third-cycle courses and study programmes

Planning and Scheduling, 4 credits

Planering och Schemaläggning, 4 hp

Course Code/Codes	50DT048
Subject Area	Computer Science (Datavetenskap)
School/equivalent	School of Science and Technology (Institutionen för naturvetenskap och teknik)
Valid from	2016-12-15
Approved	2016-12-15
Revised	,
Approved by	Head of School Peter Johansson
Translation to English, date and signature	,

1 Course content

This course provides an overview of current methods for planning. These include so-called task planning methods, where the problem is to compute actions or policies that achieve certain goals; the sub-problem of scheduling, that is, to compute when actions should take place such that temporal constraints are upheld and/or resource conflicts are avoided; and motion planning, that is the problem of finding a sequence of motions for a mobile platform that brings into a desired pose. These three problems are related in that they are often all sub-problems of a given robotic planning problem, hence the course also illustrates methods for solving these problems jointly.

The specific topics covered in the course are:
- classical planning, STRIPS as a representation and algorithm, planning as search, Graphplan and planning as satisfiability
- planning with Hierarchical Task Networks
- planning under uncertainty, MDPs and POMDPs
- constraint-based resource scheduling
- motion planning for non-holonomic robots
- coordinated motion (integrated motion planning and scheduling)

2 Outcomes

2.1 The course in relation to the doctoral programme

The course shall primarily refer to the following intended learning outcomes for third-cycle courses and study programmes as described in the Higher Education Ordinance, i.e. the doctoral student shall demonstrate:

Knowledge and understanding
- advanced and up-to-date specialised knowledge in a limited area of this field (part of outcome 1)

- familiarity with the methods of the specific field of research in particular (part of outcome 2)

Competence and skills
- the capacity for scholarly analysis and synthesis (part of outcome 3)
- the capacity to review and assess new and complex phenomena, issues and situations autonomously and critically (part of outcome 3)
- the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively (part of outcome 4)

The intended learning outcomes are listed in the same order as in the general syllabus for the programme.

2.2 Intended course learning outcomes

To obtain a passing grade, the doctoral student shall demonstrate:

Knowledge and understanding
- an understanding of the assumptions underlying common approaches to task planning, motion planning and scheduling
- an understanding of the basic difference between state-space vs. plan-space planning
- an understanding of when an application that requires task planning is best served by an HTN or a classical planning approach
- an understanding of the notion of meta-CSP reasoning for resource scheduling
- an understanding of the basic notions of sampling-based and lattice-based motion planning techniques

Competence and skills
- the ability to identify real-world situations and problems which can be formulated as task planning, motion planning and scheduling problems;
- skills to sketch solutions to solve the above problems which use heuristic search, constraint-based techniques and sampling-based methods.

Judgement and Approach
- the ability to choose the most appropriate approach among the several presented during the course for solving a specific problem, and
- an understanding of the computational and representational trade-offs of different methods

3 Reading list and other teaching material

The following course readings and teaching material will be used on the course:

Overheads/syllabus provided by the instructor and research articles. The following textbooks will be used (recommended, but not in their entirety):

Ghallab Malik, Nau Dana, Traverso Paolo (latest edition)
Automated Planning Theory and Practice
Elsevier

LaValle, Steven (latest edition)
Planning algorithms
Cambridge university press

Russell, Stuart, Norvig, Peter (latest edition)
Artificial Intelligence, A modern Approach
Prentice Hall

4 Teaching formats

Teaching on the course takes the following format:

Teaching will occur through seminars. Students will, as part of the examination, also give seminars to the class (see below).

5 Examination

The course is assessed through an examination in the format of

A seminar where the student presents and discusses one or more task planning, motion planning, or scheduling problems that are relevant to the student's research area.

6 Grades

Examinations on third-cycle courses and study programmes are to be assessed according to a two-grade scale with either of the grades 'fail' or 'pass' (local regulations).

The grade shall be determined by a teacher specifically nominated by the higher education institution (the examiner) (Higher Education Ordinance).

To obtain a passing grade on examinations included in the course, the doctoral student is required to demonstrate that he/she attains the intended course learning outcomes as described in section 2.2. Alternatively, if the course consists of multiple examinations generating credit, the doctoral student is required to demonstrate that he/she attains the outcomes that the examination in question refers to in accordance with section 5.

A student who has failed an examination is entitled to a retake.

If an examination consists of several examination components, and a student fails an examination component, the examiner may, as an alternative to a retake, set a make-up assignment with regard to the examination component in question.

A doctoral student who has failed an examination twice for a specific course or course element is entitled, upon his/her request, to have another examiner appointed to determine the grade.

7 Admission to the course

7.1 Admission requirements

To gain access to the course and complete the examinations included in the course, the applicant must be admitted to a doctoral programme at Örebro University.

7.2 Selection

Selection between applicants who have been admitted to doctoral programmes at Örebro University and who otherwise meet the admission requirements as listed above is made according to the following order of precedence:

If no other selection criteria are specified in this section, priority shall be given to applicants with a lower number of course credits left before the award of their degree over applicants with a higher number of remaining course credits. Should two or more students have equal number of credits,

selection will be done through the drawing of lots. This also applies within any selection groups listed unless otherwise stated.

7.3 Other applicants than doctoral students admitted at Örebro University

Other applicants than doctoral students admitted at Örebro University may be given access to the course on the grounds of provisions for and/or agreements regarding contracted courses, joint degrees, national graduate schools or cooperation in other respects with other universities.

Any decisions on what such other applicants may be given access to the course are made separately and on the basis of the provisions and/or agreements that occasion the student to apply for the course.

For participation in the course in other respects, the same provisions shall apply as for doctoral students admitted to Örebro University.

8 Transfer of credits for courses, study programmes and other experience

Provisions on the transfer of credits can be found in the Higher Education Ordinance and on the university's webpage.

9 Other information

The course is given in English

Transitional provisions

None.