Course proposal 2020-21

**1. Course title***: Applied Algorithms and Datastructures

**2. Instructor(s)***: Tobias Meggendorfer

**3. Track(s)*:** CS, DSSC

**4. Track segments*:** CS-ALG, DSSC-OPT

**5. Semester*:** Fall 1 + 2

**6. Duration*:** 12 x 1.5 hours lecture (no Recitations)

**7. Course type*:** Advanced

**8. Specific class room requirements:**
None, completely online.

**9. Minimum attendance**: 10

**10. Maximum attendance:** open

**11. Preferred schedule** (if applicable):
☐ Mon/Wed ☐ Tue/Thu ☒ other: After 10 am
☐ morning ☐ afternoon ☐ no preference

**12. Course is expected to be offered***
**a) 2020/21** ☐
**b) 2021/22** ☒
**c) 2022/23** ☒ (if successful)

**13. Teaching assistant:**
☐ No TA required.
☐ I will assign the TA myself.
☒ I want to advertise this course as a TAship opportunity to all PhD students.
☐ I already know the name of the TA (please indicate):

**14. Course description/course goals*:**

This course aims to teach the concepts of efficient algorithms through a practical, hands-on format. Each week treats a particular class of problems, beginning with basic data structures and simple algorithms, and continuing with more advanced topics, e.g. shortest path or dynamic programming. For each topic, an explanatory lecture and an accompanying set of problems is given. Each participant then is tasked to solve these problems on their own within one week. Each problem describes, through a story, a concrete programming task. “Solving” means to provide an implementation computing the correct answers within a given time-limit. Participants can upload solution attempts to an online platform, which immediately gives feedback on the solution attempt and no limit on the number of attempts. Solution ideas for each problem are presented in the next lecture.

The skills obtained in this course will aid you with implementation-related problems of your research. In particular, you learn to (i) analyze a concrete question from the algorithmic perspective, (ii) model the problem appropriately, (iii) estimate the time and memory requirements, and (iv) decide which algorithms can be adapted to solve the problem efficiently.

Disclaimer: This course heavily relies on self-study and trying to solve problems on your own. Depending on your experience, it will require more work than some other courses.

**15. Target audience*:**
Students with some programming experience and keen interest in problem solving.

**16. Prerequisites*:**
Basic knowledge of at least one programming language, e.g. C++, Java, or Python. Only the respective standard libraries are used, thus knowledge of Boost, scipy/numpy, etc. is **not** required.

**17. Teaching format(s)*:**
Online lecture accompanied by self-study for each week’s homework, no recitations. Participation in the lectures is not required (though recommended). The submission platform offers sending of “clarification requests” to ask for advice with a problem.

**18. Evaluation*:**
Based on the number of solved problems, i.e. completed homework. Submissions will be checked for plagiarism.

**19. Grading scheme: a) Numeric grades (1-5)** ☒ **b) pass/fail** ☐

**20. Additional remarks for the graduate school office:**
One TA would be preferable for > 15 participants. TA should have good understanding of programming and algorithmics, ideally a previous participant of ICPC (sub-)regionals. TAs help with answering clarification requests (i.e. individual questions of students) and identifying "half-point" submissions, i.e. solution attempts which are close to correct and only have a minor flaw.

Depending on the programming experience, I estimate the weekly workload to be ~5 hours for students.

*required field

**21. To be completed by GSO:**

| HP approved: | ECTS approved: | Notes: |
|---|---|---|

1. Please indicate the course title.
2. Please list all instructors for this course. If there are more than three, please indicate who will be the main contact person for organizational matters.
3. Please specify related track(s): Biology, Neuroscience, Physics, Math, CS, DSSC. Service courses are currently not assigned to any track.
4. Please specify the track segment(s) the course should be assigned to (may be one or more, also from different tracks). An overview of the current track segments can be found here.
5. Please specify the (half) semester in which you would like your course to take place:
   Fall 1 / Fall 2 / Fall 1+2/ Spring 1 / Spring 2 / Spring 1+2 (please see academic calendar for details).
6. Please indicate the length of the course: half semester / full semester / blocked course (blocked format only allowed for service courses; if applicable, indicate number of days and hours).
7. Please specify the course type: introductory (previously known as 'breadth'), advanced, track core, general core, service (please see info sheet for course instructors for details).
8. Please indicate whether there are any special requirements with respect to the class room (e.g. large whiteboards).
9. Please specify the minimum number of participants (if applicable).
10. Please specify the maximum number of participants (if applicable).
11. Please indicate your preferred teaching days. GSO will try to accommodate your wishes, however, reserves the right to suggest a different schedule.
12. Please indicate whether you are planning to offer this course in alternate years (this will help students to plan their curriculum).
13. Please indicate whether or not you will have a TA for the course and how they will be assigned, if applicable. If you want to advertise your course as a TAship opportunity to all PhD students, GSO will inform students accordingly via email and on the PhD website.

14. Please provide a course description (will be used to announce the course on the PhD website). Make sure that the goals of the course become clear.
15. Please indicate target audience.
16. Please indicate any prerequisites. It will help students to identify courses that suit their previous knowledge and experience.
17. Please indicate the teaching format(s): lectures, student presentations, project work, mentored study, etc.
18. Please specify how the final grade will be determined: regular assignments, presentations, final exam, participation etc.
19. Please indicate whether which grading scheme you would like to use a) Numeric grades (1-5 with 1 being the best and 4 the last passing grade) or b) pass/fail.
20. Field for additional remarks (e.g. on scheduling restrictions, overlaps with other courses that need to be avoided etc.)
21. To be completed by the GSO. Please note that Heaven points are a reward system for good teaching, and will be awarded for meaningful contributions to the PhD curriculum. In order for a course to qualify, it must follow the approved format. For details please refer to Memo on heaven points

a)

**Please note:**

a) Especially for **core and track core course proposals** it is essential that information on

- course contents,
- course goals,
- teaching format,
- assessment/evaluation,
- target audience and pre-requisites

are provided in **sufficient detail**.

b) All information for course instructors is available on the Graduate School Website: https://phd.pages.ist.ac.at/teaching-and-student-records/