Advanced Algorithmics (6EAP)
Project proposals

Jaak Vilo
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Key info

- Project = 1-2-3 person teams
- Poster session: May 29th (Wed)
  - 2pm - room L122
  - Poster file (PDF?) has to be uploaded before
- Prerequisite for exam

Expectations:

- Study the problem
- Implement, Evaluate, Compare, Measure, ...
- Your task is to make the project interesting to others: right questions; cool applications; novel ideas; desire to read; materials to complement next year courses.
- Find a clear objective and focus, state it, study it!
- 20-40h / per person
- Report – Poster

Tasks

- Here is a list of some proposals
- You can propose your own.
- Or select some on your own
  - from international competitions
    - e.g. IOI (ACM) olympics finals series
    - implementation challenges from DIMACS, etc.
  - etc.

Succinct data structures

- Test in practice the size and speed for some succinct data structures (binary search trees, heaps ...)
- Could you support some (any) dynamic update operations? Which kind? What would be needed basic operations for updates? (however bad the time is)

- Compare some alternative algorithms, and try to improve on them
- Take a problem and try to apply algorithmic problems to solve it
- Take an algorithm from the literature, implement and test
- Find cool ways to study/visualise algorithmic ideas presented in the course.
Clustering using Differential Evolution

- Define an objective function
- Define a numeric vector representing a clustering
- Optimise the objective function using differential result
- Report the types of clusters discovered, time and convergence, strengths and weaknesses as compared to other standard clustering methods

Combinatorial search (BFS)

- Optimal solution from a (or any) state
- “Discover” the short assembly step algorithms
- Provide solutions

Graph layout

- Graph layout
  - “Physical Spring model” with some extra added constraints or specialised nodes for stars, cliques, connection strength, etc.
- Create a nr of criteria and try to minimize nr of crossings, area of graph, etc.

Constrained Spring Embedding Layout

- Define certain areas (or lines, etc) that “attract” nodes. Allow graph to “layout” itself dynamically.

TSP variant, but with physical laws of velocity...
Visit all cities... - physically!

http://cswww.essex.ac.uk/staff/sml/gecco/PTSPComp.html
http://algoval.essex.ac.uk/ptsp/ptsp.html
• 652, 652

Seriation

• http://courses.cs.ut.ee/2009/dm/Main/HW04
• Serialise matrices
• (2-way)

Biclustering

• Ordering rows and columns to reveal modules/areas of high “coherence”

• Example: A. Tanay, R. Sharan, R. Shamir: Discovering statistically significant biclusters in gene expression data. Bioinformatics 18, Suppl.1, 236-44, 2002

Alizadeh et al., Nature 403:503-11, 2000
6.5.2013

Some algorithmic competition

- Test your skills on some algorithmic competition

Finally, 15,000 pages later:

Current SAT solvers solve this instance in approx. 1 minute!

Your own projects

- Ask a question
- Study literature
- Propose solution
- Implement
- Experiment and report results of experiments