Institut for Matematik og Datalogi
Syddansk Universitet

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JBJ

DM867 – Spring 2022– Weekly Note 14

This is the final weekly note!

Stuff covered in Week 19

I covered sections 1,2,3 and 5 in the paper by Alon et al. on color-coding. You can also find something about this in BJG Section 10.2. See also my slides on the home page and itslearning.

Pensum

Most of the material below is available via the home page of the course.

- Bang-Jensen and Gutin, Digraphs 1ed. Sections 3.1-3.5, 3.11.1-3.11-3, 7.3, 8.7 (to page 449), 9.1-9.2, 9.5, 10.2.
- Notes by Mette Eskesen on Maximum adjacency orderings (from the home page).
- Papadimitriou og Steiglitz, Combinatorial optimization, Dover Chapters 10 and 12 and Sections 17.1-17.2.
- Korte and Vygen, Combinatorial optimization, Springer Verlag 2002. Sections 8.6, 13.5 og 13.6.
- Jungnickel, Graphs, Networks and Algorithms, Springer Verlag 2005. Sections 14.5-14.6.
- Notes by Khuller Chapter 42-43.
- M.C. Golumbic, Algorithmic Graph theory and perfect graphs, Chapter 4 on Chordal graphs (minus Section 4).
- R. Niedermeier, Invitation to fixed parameter tractability, Chapter 10, Sections 10.1-10.2 and 10.4.
- Schrijver, A course in Combinatorial optimization. Lecture Notes CWI 2009. Sections 1.3, 3.1-3.5, 4.1, 5.1-5.2, 10.1-10.5
- Alon, Yuster and Zwick, Color-coding: a new method for finding simple paths, cycles and other small subgraphs within large graphs, STOC 1994 (see homepage).

- All weekly notes, including the assignments that were covered.
- Both sets of exam problems.

Exam info

The exam will be 30 minutes per person including the time for deciding your grade. You will have 30 minutes preparation after you have drawn your exam question.

The exam starts at 8.00 on June 1. The exam rooms will be announced via Itslearning. The first student will draw an exam question at 8.00 and the exam will start at 8.30, where the next on the list draws his/her question etc.

You will have about ca 15-18 minutes to cover the question you have drawn and then the external examinator and I will ask questions in other parts of the pensum for about 5-10 minutes.

Please note that, on the day of your exam, you must show up well ahead of the time that you could infer from your number on the eaxm list, as there could be some students who cannot come due to illness etc.

Exam Questions

In the parantheses I give examples of things you can talk about, but there are many other possible choices. Note also that in the second part of your exam I may ask questions in the full curriculum (not just the exam topics below).

1. **Edge-connectivity of graphs** (Menger's theorem, max back orderings and determining the edge-connectivity via these, Gomory Hu trees, edge-connectivity augmentation (both the general case via splitting off methods and augmention a tree to a 2-edge-connected graph)).
2. **Lovasz's splitting theorem with applications** (edge-connectivity augmentation, using the theorem to prove Nash-Williams orientation theorem).
3. **Arc-disjoint branchings** (Edmonds' branching theorem and the algorithmic proof of this, relation to edge-disjoint spanning trees (problem 6A in first set of exam problems), proving that every k-arc-strong digraph D is weakly-k-linked).
4. **(Arc-)Disjoint paths in digraphs** (Proof that the 2-path problem is NPC, k-path problem for acyclic digraphs, weak linkages (arc-disjoint paths)).

5. **Matroid intersection and partition** (Edmonds' algorithm for finding a maximum size common independent set of two matroids, correctness of the algorithm, matroid partition, applications of matroid intersection and partition, such as finding edge-disjoint spanning trees).

6. **Chordal graphs** (recognition via LexBFS, perfect elimination orderings, representation as intersection graphs, polynomial algorithms for clique, chromatic number etc).

7. **Tree-width** (definitions and properties of tree-decomposotions, cops and robber game and tree-width, relation to chordal graphs, using tree-decompositions to solve vertex cover and chromatic number).

8. **Color-coding and Acyclic sudigraph method** (finding a path or cycle of length k using the acyclic subdigraph method or color-coding, finding a k-cycle in a graph from a minor-closed class of graphs).