EXAM of FOUNDATIONS OF COMPUTER SCIENCE

Written Exam: exercises on regular and context free languages (grammars, automata, regular expressions, the two pumping lemma). All the exercises contained in chapt.'s 1 and 2 of [S] and in chapt.'s 2-6 of [HU] are examples of what you may find in a written exam.

REMARK: both books contain more material than what we present in this course; so be careful when you choose your exercises therein.

Oral exam:

- To pass the exam (with mark between 18 and 24), you will be required to know:
  - All definitions, examples and theorem statements;
  - The proofs of the following theorems:
    - From Sipser's book [S]:
      1. 1.39 (determ vs nondeterm),
      2. 1.45, 1.47, 1.49 (closures of reg.lang.'s),
      3. 1.55 (from reg.expr.'s to finite aut.),
      4. 1.70 (pumping lemma reg.lang.),
      5. 2.21 (from CFG to PDA),
      6. 3.21 (enumerators vs TM),
      7. 4.1, 4.2, 4.3, 4.4, 4.5 (decid. of membersh./emptin./equiv. in RL),
      8. 4.7, 4.8 (decid. of membership/emptiness in CFL),
      9. 5.9 (dec. of membership LBA),
      10. 4.22 (decidability vs R.E. and existence of non-RE lang's),
      11. 5.1 (halting prob.),
      12. 7.20 (NP = polytime verific.),
      13. 7.31 (pol.reduc. in P),
      14. 7.36 (pol.reduc. in NPC),
      15. 7.55 (HAM-PATH < U-HAM-PATH).
    - From Hopcroft&Ullman's book [UL]:
      16. Thm 9.1, 9.2 (reg.gramm. vs FA)
    - From Cormen&Leiserson&Rivest's book [CLR]:
      17. 34.10 (sat < 3cnfsat),
      18. 34.12 (clique < vertex cover),
      19. 34.14 (ham cycle < tsp),
      20. 35.1 (approx. vertex cover).

- To have a high mark (between 24 and 30), you will be further required to know the proofs of the following theorems:
    - From Sipser's book [S]:
      1. 1.60, 1.64 (from DFA to reg.expr.),
      2. 2.27 (from PDA to CFG),
      3. 2.34 (pumping lemma CFL),
      4. 3.13 (multitape vs single tape TM),
      5. 3.16 (nondet. vs det. TM),
      6. 4.11 (undec. of membership TM),

7. 7.8 (complexity of reduc. multitape to single tape),
8. 7.11 (complexity of reduc. nondet to det),
9. 8.25 (PATH is NL-complete).

- From Hopcroft&Ullman's book [UL]:
  10. Thm 9.3 (0 gramm. to TM),
  11. Thm 9.5 (CSG in LBA).
- From Cormen&Leiserson&Rivest's book [CLR]:
  12. 34.1 (polynomially related encodings),
  13. 34.11 (3cnfsat < clique),
  14. 35.2, 35.3 (approx. tsp with/without triangle eq.).

- To pass the exam *cum laude*, you will be asked one of the following proofs:
  - From Sipser's book [S]:
    1. 5.10 (undec. emptiness LBA),
    2. 5.13 (undec. all Σ* for CFL),
    3. exercise 5.28 (Rice's theor.),
    4. 7.37 (Cook Levin),
    5. 7.46 (3cnfsat < HAM-PATH),
    6. 8.9 (TQBF is PSPACE-complete).
  - From Hopcroft&Ullman's book [UL]:
    7. Thm 9.4 (TM to 0 gramm.),
    8. Thm 9.6 (LBA to CSG).
  - From Cormen&Leiserson&Rivest's book [CLR]:
    9. 34.15 (3cnfsat < subset sum),
    10. 35.8 (PTAS for subset sum).