CS 185	Handout #2
Spring 1999	March 30, 1999

Syllabus(Tentative)

1. Introduction (Handout of Chapter 1 and 2 from [Pin95])
   (a) Models
   (b) Notation
   (c) Applications
   (d) NP-completeness, Approximation, Linear Programming
2. Minimizing Schedule Length
   (a) Solving P$|pmtn|C_{\max}$ [McN59] [KSW - Sec. 2.3.2] - lower bounds
   (b) P$||C_{\max}$
      i. List scheduling (2-approximation)
      ii. LPT (4/3-approximation)
      iii. Polynomial Approximation Scheme [HS87] [KSW - Sec. 3.3,6.2]
   (c) P$|prec|C_{\max}$ [KSW - Sec. 2.3.4]
      i. NP-hardness of P$|prec, p_j = 1|C_{\max}$
      ii. Algorithms for P2$|p_j = 1|C_{\max}$ [Gab82]
      iii. List Scheduling for P$|prec|C_{\max}$ (2-approximation)
   (d) Linear programming
   (e) R$|pmtn|C_{\max}$ [LL78] – introducing Linear programs in scheduling [KSW - Sec. 4.1]
   (f) R$||C_{\max}$ [ST93] – using linear program relaxations to get approximation algorithms [KSW - Sec. 5.1]
3. Scheduling with Deadlines on One Machine
   (a) $1||L_{\max}$ - EDD [KSW - Sec. 2.1.2]
   (b) $1|r_j, pmtn|L_{\max}$ - preemptive EDD (introducing release dates) [KSW - Sec. 2.1.3]
   (c) $1|prec|f_{\max}$ - Least Cost Last [Law73] [KSW - Sec. 3.1.1]
   (d) $1|pmtn, r_j, prec|f_{\max}$ [KLLK83]
   (e) Approx. algorithms for $1|r_j, prec|L_{\max}$ and $1|r_j|L_{\max}$ [HS89, Hal97] [KSW - Sec. 6.3.2]
   (f) Extension to parallel machines, a 2 approximation for P$|r_j|L_{\max}$ [HS89, Hal97]
   (g) $1||\sum w_j U_j$ - Dynamic programming solution, weak NP-completeness [KSW - Sec. 3.2,6.1]
4. Scheduling to Minimize weighted completion time

(a) $1||\sum w_j C_j$ - Smith's rule [KSW - Sec. 2.1.1]
(b) Exact solutions to R$||\sum C_j$ via linear programming and matching, specializations to P$||\sum C_j$ [KSW - Sec. 4.1]
(c) Solving P$|pmtn|\sum C_j$ [McN59]
(d) Dealing with release dates and precedence constraints
    i. Solving $1|r_j, pmtn|\sum C_j$ via SRPT [KSW - Sec. 2.1.3]
    ii. Approximations for $1|r_j|\sum C_j$ and P$|r_j|\sum C_j$ [PSW98] – using relaxations [KSW - Sec. 5.2]
    iii. Using LP relaxations and dealing with precedence constraints, P$|r_j|\sum w_j C_j$ [HSSW97]
    iv. Improvements through randomization for $1|r_j|\sum C_j$ [CMNS97]

5. On-line Scheduling
    (a) Review of previous algorithms that were on-line
    (b) On-line arrivals, minimizing makespan [SWW95]
    (c) On-line arrivals, minimizing $\sum w_j C_j$ [HSSW97, CPS+96]
6. On-line Load Balancing [AAF+93], maybe more
7. Shop Scheduling Models
8. Scheduling Jobs in Parallel Environments
    (a) Branch and Bound - [KZ93]
    (b) Packet Routing and scheduling [LMR94]
    (c) Network Scheduling [PSW98]
    (d) Communication Delays [PY90]
9. Optional Topics - More scheduling models and problems

References

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