1 Algorithms II (FMS)

(a) In the context of multithreaded algorithms, define work and span, and state the work law and the span law. [3 marks]

(b) Prove that the performance of a greedy scheduler is optimal to within a factor of 2. (Proving all intermediate theorems is not required if you state them correctly.) [4 marks]

(c) Version A of a multithreaded algorithm takes 500 seconds on a uniprocessor machine and 50 seconds on a 32-processor machine. Version B takes the same time as A on a single processor but only 24 seconds on the 32-processor machine.

(i) Define the parallelism of a computation and compute the parallelism of algorithms A and B. Which of the two has higher parallelism, and by how much? (Hint: use one of the greedy scheduler theorems to derive an approximation for one of the unknowns.) [6 marks]

(ii) Estimate the running times of algorithms A and B on a 4-processor and on a 1024-processor machine, explaining how you obtain them. [3 marks]

(iii) Sketch possible computation DAGs for algorithms A and B and use them to discuss the results obtained. As the number of processors in the host machine varies, is A or B faster? [4 marks]