Assignment 3
CSC373 Winter 2009
Due Date: April 9th, Noon, BA2220 Drop Box 7

Problem 1

DPV 7.24

Problem 2

Consider the Bin Packing problem: given positive integer B, and a list of integers A = [$a_1, \ldots, a_n$] (where $0 < a_i \leq B$), try to partition A into as few cells as possible such that for each cell of the partition, the sum of the elements in the cell is at most B.

The FirstFit algorithm takes each element of A in turn (note that we do NOT sort the objects by size) and places it into the first bin that can accommodate it.

For example, suppose B = 10 and A = [2, 2, 7, 8, 3, 6, 3, 2, 6]. FirstFit would use 5 bins and fill them as follows: Bin(1) contains 2, 2, 3 and 3; Bin(2) contains 7 and 2; Bin(3) contains 8; Bin(4) contains 6; and Bin(5) contains 6.

Let $S = \sum_{i=1}^{n} a_i$

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(a) Argue that the optimum number of bins required is at least $\lceil S/B \rceil$.

(b) Argue that the FirstFit algorithm leaves at most one bin less than half full.

(c) Prove that the number of bins used by FirstFit is never more than $\lceil 2S/B \rceil$.

(d) Prove an approximation ratio of 2 for the FirstFit algorithm. That is, prove that for any input A and integer B, FF uses at most twice the number of bins that an optimal algorithm would use.

Problem 3

DPV 9.5

Problem 4

DPV 7.16 (I like http://vinci.inesc.pt/lp/, once you get the hang of the syntax).