

Assignment 2 — 2017

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Q0 [25]

(a) [5] Give a contract for a procedure that computes all ways to partition a set S into two disjoint subsets.

(b) [5] Design the procedure in pseudocode. Build the sets on the way up.

(c) [5] Give a second design in pseudocode. This time build sets on the way down.

(d) [10] Implement both designs in the programming language of your choice and test. Submit code and tests via D2L.

Q1 [25] Give a recursive search procedure for the following problem: We are given a set of $n \geq 0$ jobs $\{0, \dots, n\}$. Each job j is associated with a positive integer value $v(j)$. We wish to divide the jobs between two workers so the difference in total work is as close as possible to a goal g . That is we want to minimize $|(w_0 - w_1) - g|$ where w_0 is the sum of the values of jobs assigned to worker 0 and w_1 is the sum of the values of jobs assigned to worker 1.

(a) [5] Give a contract for a procedure that solves this problem

(b) [10] Write the pseudocode for the procedure. Give contracts and pseudocode for any additional procedures you need. Don't worry about efficiency. A recursive solution that takes exponential time is fine.

(c) [10] Implement your pseudocode in the programming language of your choice. Test your code on some examples. Submit code and tests via D2L.

Q2 [20] An M-expression is one of the following: An identifier such as *foo* or *bar*. A function call such as *foo*[], *foo*[*bar*], or *foo*[*bar*[], *baz*]. A conditional expression such as

$$[foo \rightarrow bar[bee]; baz[bar] \rightarrow fie]$$

A lambda expression such as $\lambda bar, baz \cdot foo[bar, baz]$.

Give a context-free grammar for M-expressions.

Be sure to describe the alphabet, the nonterminal set, the starting nonterminal, and the production set of the grammar.

Note:

- You may represent all identifiers by a single member of the alphabet.
- In function calls, there may be zero or more arguments separated by commas; each is an M-Expression.
- In conditional expressions, there may be any number of clauses separated by semi-colons. Each clause is an pair of M-Expressions separated by an arrow.
- In lambda expressions, the parameter list before the dot should consist of zero or more identifiers separated by commas. After the dot, there is a single M-expression.