CS2302 - Data Structures
Spring 2019
Lab # 8
Algorithm Design Techniques

Deadline: Thursday, May 9, 2019

1. (Randomized algorithms) Write a program to "discover" trigonometric identities. Your program should test all combinations of the trigonometric expressions shown below and use a randomized algorithm to detect the equalities. For your equality testing, generate random numbers in the $-\pi$ to π range.
   (a) $sin(t)$
   (b) $cos(t)$
   (c) $tan(t)$
   (d) $sec(t)$
   (e) $-sin(t)$
   (f) $-cos(t)$
   (g) $-tan(t)$
   (h) $sin(-t)$
   (i) $cos(-t)$
   (j) $tan(-t)$
   (k) $\frac{sin(t)}{cos(t)}$
   (l) $2\,sin(t/2)\,cos(t/2)$
   (m) $sin^2(t)$
   (n) $1 - cos^2(t)$
   (o) $\frac{1-cos(2t)}{2}$
   (p) $\frac{1}{cos(t)}$
2. (Backtracking) The partition problem consists of determining if there is a way to partition a set of integers S into two subsets S_1 and S_2 such that $\sum S_1 = \sum S_2$. Recall that S_1 and S_2 are a partition of S if and only if $S_1 \cup S_2 = S$ and $S_1 \cap S_2 = \{\}$. Write a function that solves the partition problem using backtracking. If a partition exists, your program should display it; otherwise it should indicate that no partition exists. For example, if $S = \{2, 4, 5, 9, 12\}$, your program should output the partition $S_1 = \{2, 5, 9\}$ and $S_2 = \{4, 12\}$ and if $S = \{2, 4, 5, 9, 13\}$ your program should indicate that no partition exists.

Given the little time available, a demo will not be required, thus it is very important that your report accurately describes your work.