Computer Science 355
Modern Computer Algebra

Assignment 2

Due date: Feb. 08
Objective: Gosper's algorithm

Your name:

Problem 1 (Programming) (20 pts)

Write a program which takes an arbitrary list of integers as input, and produces a new list, which consists of {value, run-length} pairs describing the given input string. This is known as Run-Length Encoding. For example, the imput string

{ 7, 8, 8, 9, 9, 9, 9, 5, 5, 5, 5, 9, 9, 9 }

should produce the following output

{{ 7, 1 }, { 8, 2 }, { 9, 4 }, { 5, 4 }, { 9, 3 }}

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RunLength[lst_List] :=
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Problem 2 (20 pts)

Evaluate the sum using Gosper' s algorithm

$$\sum_{k} k \, \frac{\left(k - \frac{1}{2}\right)!^2}{(k+1)!^2}$$

Demonstrate each step of the algorithm using *Mathematica*.

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Problem 3 (20 pts)

Prove that this sum is not Gosper-summable

$$\sum_{k} (-4)^k \binom{n+k}{2k}$$

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Problem 4 (20 pts)

Let m be a positive integer, $p(k)$ a polynomial of degree $m - 1$ and c a constant. Determine is the following sum is Gosper-summable

$$\sum_k \frac{p(k)}{\prod_{j=0}^{m-1} (k + c + j)}$$

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Problem 5 (20 pts)

Let a be a parameter and

$$p_k = \binom{2\,k}{k} a^k$$

Find all values of a such that p_k is Gosper-summable.

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