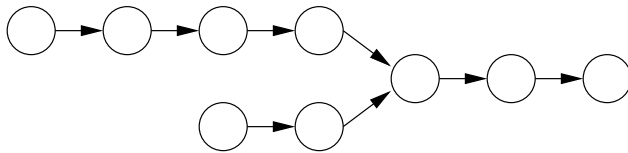


Homework Assignment #9
Due: August 4, 2023 at 10:00 p.m.

- [3] **1.** Suppose we want a universal class of hash functions from the universe $U = \{0, 1, \dots, N - 1\}$ to the hash table slots $\{0, 1, \dots, m - 1\}$. Gaurav proposes the following class: $G = \{h_a : 0 < a < p\}$ where p is a prime number with $p > N$ and $h_a(k) = (ak \bmod p) \bmod m$. (This is similar to the class of hash functions that we discussed in class, except there is no additive b term.)

Let's consider a small example: $m = 4$, $N = 6$ and $p = 7$. Is G a universal class of hash functions for these parameters? Prove your answer is correct.

- [4] **2.** Suppose you are given the addresses of the first nodes in two singly-linked lists and the lengths n_1 and n_2 of the two lists. Each node contains a *next* field that stores the address of the next node in the list. The two lists may contain a common suffix, as shown in the example below (where $n_1 = 7, n_2 = 5$ and the longest common suffix has length 3).



Design a fast algorithm to compute the length of the longest common suffix of the two lists. Your algorithm should not modify the lists, but you may use randomization and $O(n_1 + n_2)$ extra space. Give a precise description of any data structures used by your algorithm. Give a good upper bound on the expected running time of your algorithm in terms of n_1 and n_2 .