

TDT4305 2021 - Assignment 5 solution

1. For a stream of integers, we maintain a Bloom filter answering which integers have been seen so far. Assume the following hash functions: $h_1(x)=2x \bmod 10$, $h_2(x)=3x \bmod 10$.

- a) For the incoming stream values 6, 18, and 3, fill in the table below and update the Bloom filter.

Time	Element	h_1	h_2	Filter
1	6	2	8	0010000010
2	18	6	4	0010101010
3	3	6	9	0010101011

2. For the following bit stream, we want to estimate the number of 1-bits in the last k bits. The left-most bits are the oldest.

- a) Divide the following bit stream into a valid set of buckets using the DGIM algorithm.

... 1101001 00 101101 0000 101 00 101 0

- b) Update the buckets after the arrival of one more bit.

... 1101001 00 101101 0000 101 00 101 0 1

- c) Calculate the estimated number of 1 bits in the latest 20 bits using the DGIM algorithm with guaranteed maximum 50% error. What is the error in this case?
- Estimated number of 1 bits: 7
 - 0.222% error