TDT4305 2021 - Assignment 5

1. For a stream of integers, we maintain a Bloom filter of length 10 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	18			
3	3			

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.

   … 1 1 0 1 0 0 1 0 0 1 0 1 1 0 1 0 0 0 0 1 0 1 0 0 1 0 1 0

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

   … 1 1 0 1 0 0 1 0 0 1 0 1 1 0 1 0 0 0 0 1 0 1 0 0 1 0 1 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?