Exercise 04:

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Problem 4.1 - Bloom Filters

A. The probability that certain bit will be still 0 after inserting n elements into array size m with k hash functions is $:(1-1/m)^{k^*n}$, the probability that bit set to 1 is $:1-(1-1/m)^{k^*n}$

B. $H_1(9) = 4$, $H_2(9) = 1$, $H_1(11) = 1$, $H_2(11) = 0$ Initially:

0	0	0	0					
After insertion 9:								
0	1	0	1					
After insertion 11:								
1	1	0	1					

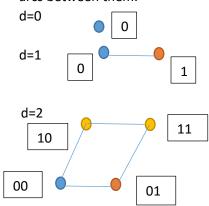
C. For value 15, $H_1(15) = 0$, $H_2(15) = 3$.the bit at position 0 is set to 1 but the bit in position 3 is set to 1,15 is not member, and bloom filter provided correct answer. For value 16, $H_1(16) = 1$, $H_2(16) = 0$.the bit at position 0 is set to 1 and the bit in position 1 is set to 1, the bloom filter provide false positive since 16 is not member.

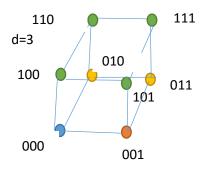
D.

	0	1	2	3	4	5	6	7	8
1/2	0	1	0	0	1	1	0	0	0
1/4	0	1	1	1	1	0	0	0	1
1/8	0	1	1	1	1	0	0	0	1

Problem 4.2 - Hypercube Networks

A. If(d =0) we will draw one node else will draw two hypercubes of dimension (d-1) and add arcs between them.





B. Routing from 001 to 110 :there are 3 options (011,000,101) so distance =3
We will choose route cross 011 ,there are 2 options(111,010) distance =2
We will choose 111 and 110 is direct neighbor