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Some of the answers were arrived at while working in group with:
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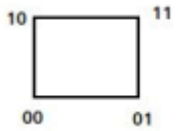
Problem 6.1

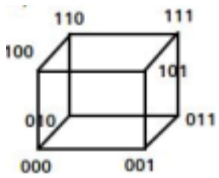
A. Solution:
   → For d = 0,

   → For d = 1,

   → For d = 2,



   → For d = 3,



B. Solution:
   → Routing step #1
      - 3 possibilities : 000, 101, 011
      - Let's pick 000
   → Routing step #2
      - 3 possibilities : 001, 010, 100
      - Let's pick either 010 or 100
      - The next routing will be to 110

Problem 6.2

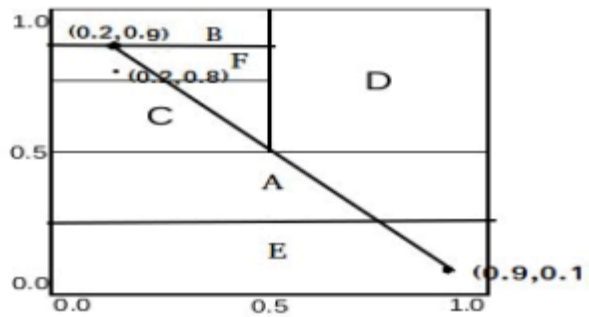
A. Solution:
   → **Gnutella 0.4 :** Each node joins and acts as individual nodes which contains shared data.
   → **Gnutella 0.6 :** The new node joins the network and becomes a leaf node to one of the Super Peers in the network. The Super Peer holds the routing information and shared data of the leaf nodes connected to that Super Peer. Leaf nodes communicate with each other using HTTP.

B. Solution:
   → **Gnutella 0.4 :** Enhanced flooding technique is used between peers during search queries. Each node floods the query to its neighboring nodes until it gets a response.
   → **Gnutella 0.6 :** Super Peer floods the query to its neighboring Super Peers until it gets a response. The Super Peer maintains the routing table and information about the leaf nodes connected to it.

C. Solution:
   → For $t_{0.4}$=8, n=5 :
   Maximum number of reachable users = 109,225

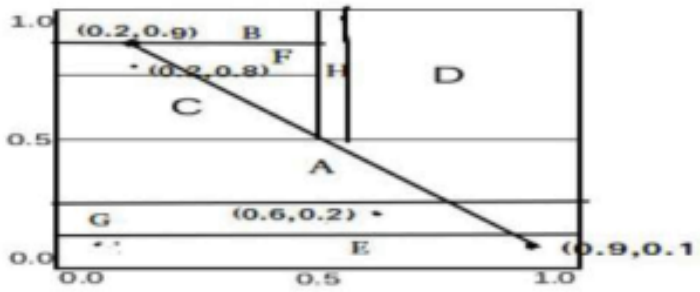
Problem 6.3

A. Solution:



B. The Optimal Path will be :
   ○ E → A
   ○ A → C
   ○ C → F
   ○ F → B

C. Solution:



Problem 6.4

A. Solution:
   - → **P(**bit is not set by a hash function**)** = 1-1/m
   - → **P(**bit not set by any of the hash functions**)** = $(1-1/m)^k$
   - → **P(**bit not set after n-insertions**)** = $(1-1/m)^{kn}$
   - → This gives, **P(**bit set to 1 after n-insertions**)** = $1-(1-1/m)^{kn}$

B. Values of Hash functions for 9, 11:
   - → H1(9)=4
   - → H2(9)=1
   - → H1(11)=1
   - → H2(11)=0

     0 0 0 0 0
     0 1 0 0 1
     1 1 0 0 1

C. Solution:
   - → H1(15) = 0
   - → H2(15) = 3

     Since the bit at position 3 is set to 0, 15 is not a member. Therefore, the Bloom Filter provides the correct answer.

   - → H1(16) = 1
   - → H2(16) = 0

     Both bits are set to 1. Therefore, the Bloom Filter provides a false positive since 16 is not an inserted member.

D. Solution:

	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	1	0	0	1