Sample Solution - Class Test 4

1. **Assume that the roll number is 18CS30018.**

   Then, N = 3001

   (a) Number of IPs required for each block,

   Administration: 3001
   Hostel-1: 6002
   Hostel-2: 9003
   Residential: 3001
   Academic-1: 15005
   Academic-2: 18006

   With the constraint that we cannot use more than 100 IPs, the subnet requirements for each of the blocks are as follows.

   Administration:

   Two subnets --

   A1 -- 2000 hosts -- 11 bits
   A2 -- 1001 hosts -- 10 bits

   Hostel-1:

   Two subnets --

   H11 -- 4000 hosts -- 12 bits
   H12 -- 2002 hosts -- 11 bits

   Hostel-2:

   Five subnets --

   H21 -- 2000 hosts -- 11 bits
   H22 -- 2000 hosts -- 11 bits
   H23 -- 2000 hosts -- 11 bits
   H24 -- 2000 hosts -- 11 bits
   H25 -- 1003 hosts -- 10 bits

   [This case can also be handled with 4000, 4000, 1003 hosts. However, 3 subnets mean you need 3 bits for subnet IP. With 3 bits in the subnet IP, you can have a maximum of 6 subnets, by avoiding all-zero and all-one subnets. So, it is better to go for 5 subnets with 2000 hosts maximum, as you can save 1 bit in the host IP part -- 4000 hosts need 12 bits in the host IP.]

Residential:

Two subnets --

A1 -- 2000 hosts - 11 bits
A2 -- 1001 hosts - 10 bits

Academic-1:

Five subnets --

A11 -- 4000 hosts - 12 bits
A12 -- 4000 hosts - 12 bits
A12 -- 4000 hosts - 12 bits
A13 -- 2000 hosts - 11 bits
A14 -- 1005 hosts - 10 bits

[Similar to Hostel-2, we can go for 8000 hosts, but that will take 1 more bit in the host IP part.]

Academic-2:

Five subnets --

A21 -- 4000 hosts -- 12 bits
A22 -- 4000 hosts -- 12 bits
A23 -- 4000 hosts -- 12 bits
A24 -- 4000 hosts -- 12 bits
A25 -- 2006 hosts -- 11 bits

[Similar to Hostel-2, we can go for 8000 hosts, but that will take 1 more bit in the host IP part. As we already have 3 bits in the Subnet IP field, we preferred to go for five subnets.]

(b) **Administration:**

We have two subnets, maximum of 11 bits per subnet. Two subnets need 2 bits for the subnet address. So, a total of 13 bits are required. Therefore the subnet mask will be /(32-13) = /19

Hostel-1

We have two subnets, maximum of 12 bits per subnet. Two subnets need 2 bits for the subnet address. So, a total of 14 bits are required. Therefore the subnet mask will be /(32-14) = /18

Hostel-2:

We have five subnets, maximum of 11 bits per subnet. Five subnets need 3 bits for the subnet address. So, a total of 14 bits are required. Therefore the subnet mask will be /(32-14) = /18

Residential:

We have two subnets, maximum of 11 bits per subnet. Two subnets need 2 bits for the subnet address. So, a total of 13 bits are required. Therefore the subnet mask will be /(32-13) = /19

Academic-1:

We have five subnets, maximum of 12 bits per subnet. Five subnets need 3 bits for the subnet address. So, a total of 15 bits are required. Therefore the subnet mask will be /(32-15) = /17

Academic-2:

We have five subnets, maximum of 12 bits per subnet. Five subnets need 3 bits for the subnet address. So, a total of 15 bits are required. Therefore the subnet mask will be /(32-15) = /17

(c) The university needs six subnets with a maximum of 15 bits for a single subnet (among the 6 blocks as discussed in part (b) of the answer). Six subnets need 3 bits, so a total of 15+3 = 18 bits are needed. Therefore the subnet address will be /(38-18) = /14

(d) Subnet mask is /14, so a feasible block of IP address will be 10.168.0.0/14

(e) Use combinations of 15th, 16th, and the 17th bit to get the subnet IPs for the six subnets. A possible allocation will be as follows.

Administration: 10.168.128.0/19
Hostel-1: 10.169.128.0/18
Hostel-2: 10.169.0.0/18
Residential: 10.171.0.0/19
Academic-1: 10.171.128.0/17
Academic-2: 10.170.0.0/17

2. In a distributed Bellman-Ford algorithm, the updates from individual nodes are asynchronous. Therefore we cannot define a fixed convergence criteria for reaching

to the solution. Therefore, we select the reverse path asynchronously when one node receives the route update (distance vector) messages from its neighbors.
The maximum hop is bounded to ensure there is no infinite convergence due to count-to-infinity problem.

(f) The routing table will be as follows.

Network IP	**Subnet Mask**	**Next Hop**
10.168.128.0	/19	GW_ADMIN
10.169.128.0	/18	GW_H1
10.169.0.0	/18	GW_H2
10.171.0.0	/19	GW_RES
10.171.128.0	/17	GW_A1
10.170.0.0	/17	GW_A2
0.0.0.0	/0	GW_NKN