PROBLEM 1

(ES.1-a) The main reason because IPs are function of the location is because of 'scalability'. An IP address is made of 32 bits divided in groups of 8;
By design of IPs it's easy to create subnets made by a given range of addresses.
How IP portion are assigned to subnets is chosen by the CIDR strategy.
This has made possible to assign portion of addresses to different tier ISPs (internet service providers) all around the world. So an organization can ask to his REGIONAL ISP for a bunch of addressed, from the range already assigned to the ISP, in order to build it's own subnet. In this way a router must now just the subnet prefix of the destination IP instead of keep in memory the position of every host. Note that we have DNS too speeding up this process.

I want to point out that IP are not fixed, when you connect to a subnet there is the DHCP protocol to dinamically assign IP in a lowest tier subnet.
The TCP/IP protocol guarantee a stability in the connection of 2 host, but is based on the fact that during a TCP (or UDP) session the IP doesn't change. If so, you lose the TCP SOCKET connection and the other host won't be able to reach you. That's why with mobility we must change our communication model.

(ES.1-2) It follows a description of mobile IP with INDIRECT ROUTING in the case where we have 2 hosts A, B out of their home networks H_A, H_B; we will call the visited foreign networks F_A, F_B.

(0) Both A and B have a permanent address with most significative bits representing their HOME NETWORKS;

(1) If A want to send a packet to B, it will send it to H_B

(2) H_B forward the packet to F_B (by the CARE-OF-ADDRESS) that can easily reach B

(3) The reply of B is sent to H_A

(4) H_A forward the packet to F_A (by the CARE-OF-ADDRESS) that can easily reach A

(ES.1-3)

Mobile IP is said to preserve the privacy because:

- in INDIRECT ROUTING, only your HOME NETWORK knows your FOREIGN ADDRES, so your real position in the network; so the sender knows only your permanent address associated with your HOME NETWORK.
- in DIRECT ROUTING isn't the same because your HOME NETWORK says to the sender your current FOREIGN NETWORK.

It's also said that MOBILE IP is scalable because, both DIRECT and INDIRECT Routing let END-POINT handle the mobility instead of letting the infrastructure (ROUTERS) memorize and update every mobile location, that would be an infeasible solution with mobility (AS has been done in JAPAN to guarantee connection in case of earthquake).

PROBLEM 2

(ES.1-a) The BOTTLENECK of OSPF is clearly the broadcast phase, because each of the n node must send it's DISTANCE VECTOR to each other, so it send $n(n-1) = \Theta(n^2)$ MSGs.

(ES.1-b)

• ROUTING TABLE NODE 1

TO	PATH	LENGHT
1	{1}	∅
2	{1,2}	1
3	{1,3}	1
4	{1,4}	1
5	{1,2,5}	2
6	{1,4,6}	2
7	{1,2,7}	2
8	{1,2,5,8}	3
9	{1,2,5,9}	3
10	{1,2,5,9,10}	4

• ROUTING TABLE NODE 2

TO	PATH	LENGHT
1	{2,1}	1
2	{2}	0
3	{2,5,3}	2
4	{2,1,4}	2
5	{2,5}	1
6	{2,1,4,6}	3
7	{2,7}	1
8	{2,5,8}	2
9	{2,7,9}	2
10	{2,7,9,10}	3

• ROUTING TABLE NODE 3

TO	PATH	LENGHT
1	{3,1}	1
2	{3,1,2}	2
3	{3}	0
4	{3,1,4}	2
5	{3,5}	1
6	{3,1,4,6}	3
7	{3,5,2,7}	3
8	{3,5,8}	2
9	{3,5,9}	2
10	{3,5,9,10}	3

• ROUTING TABLE NODE 4

TO	PATH	LENGHT
1	{4,1}	1
2	{4,1,2}	2
3	{4,1,3}	2
4	{4}	0
5	{4,1,3,5}	3
6	{4,6}	1
7	{4,1,2,7}	3
8	{4,6,8}	2
9	{4,6,8,9}	3
10	{4,6,8,9,10}	4

• ROUTING TABLE NODE 5

TO	PATH	LENGHT
1	{5,3,1}	2
2	{5,2}	1
3	{5,3}	1
4	{5,3,1,4}	3
5	{5}	∅
6	{5,8,6}	2
7	{5,2,7}	2
8	{5,8}	1
9	{5,9}	1
10	{5,9,10}	2

• ROUTING TABLE NODE 6

TO	PATH	LENGHT
1	{6,4,1}	2
2	{6,8,5,2}	3
3	{6,4,1,3}	3
4	{6,4}	1
5	{6,8,5}	2
6	{6}	0
7	{6,8,9,7}	3
8	{6,8}	1
9	{6,8,9}	2
10	{6,8,9,10}	3

• ROUTING TABLE NODE 7

TO	PATH	LENGHT
1	{7,2,1}	2
2	{7,2}	1
3	{7,2,5,3}	3
4	{7,2,1,4}	3
5	{7,2,5}	2
6	{7,9,8,6}	3
7	{7}	∅
8	{7,9,8}	2
9	{7,9}	1
10	{7,9,10}	2

• ROUTING TABLE NODE 8

TO	PATH	LENGHT
1	{8,6,4}	2
2	{8,5,2}	2
3	{8,5,3}	2
4	{8,6,4}	2
5	{8,5}	1
6	{8,6}	1
7	{8,9,7}	2
8	{8}	0
9	{8,9}	1
10	{8,9,10}	2

• ROUTING TABLE NODE 9

TO	PATH	LENGHT
1	{9,5,3,1}	3
2	{9,7,2}	2
3	{9,5,3}	2
4	{9,8,6,4}	3
5	{9,5}	1
6	{9,8,6}	2
7	{9,7}	1
8	{9,8}	1
9	{9}	0
10	{9,10}	1

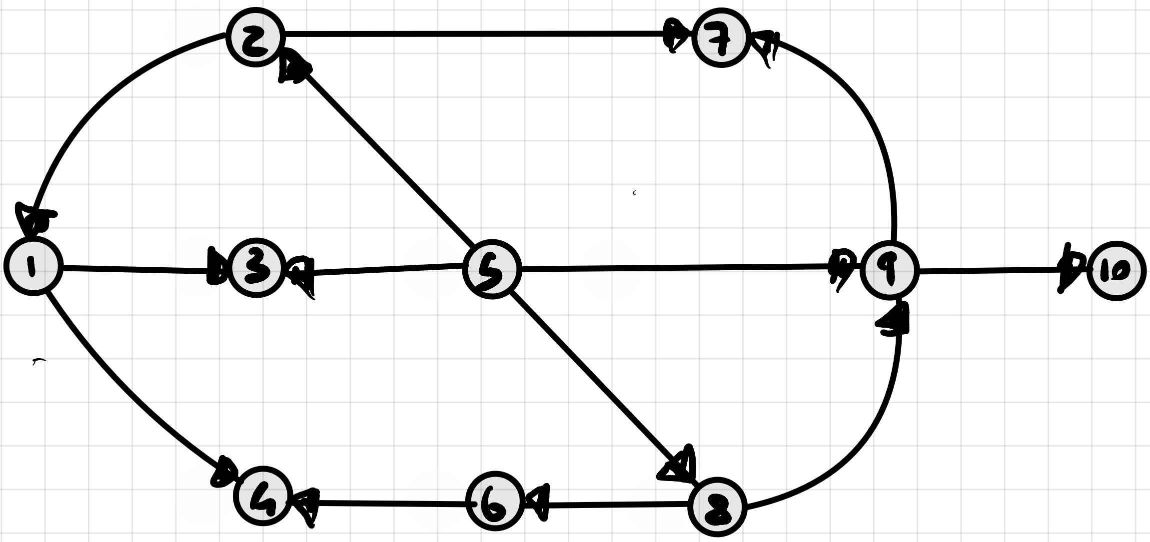
• ROUTING TABLE NODE 10

TO	PATH	LENGHT
1	{10, 9, 7, 2, 1}	4
2	{10, 9, 7, 2}	3
3	{10, 9, 5, 3}	3
4	{10, 9, 8, 6, 4}	4
5	{10, 9, 5}	2
6	{10, 9, 8, 6}	3
7	{10, 9, 7}	2
8	{10, 9, 8}	2
9	{10, 9}	1
10	{10}	0

(Ex.2-a) The MPR set of a node i is the minimum set of 1-hop neighbors of i such that every two-hop neighbor is reachable throw MPR(i).

NODE i	1	2	3	4	5	6	7	8	9	10
MPR(i)	{2, 4}	{5, 1}	{5, 1}	{1, 6}	{9, 2, 8}	{8, 4}	{9, 2}	{9, 5, 6}	{5, 8}	{9}

(Ex.2-b) Because we have an unweighted graph, The logical topology built by OLSR can be any one that span all nodes, for example starting from node 5:



NODE i	1	2	3	4	5	6	7	8	9	10
MS(i)	{2, 3, 4}	{1, 5, 7}	{∅}	{1, 6}	{2, 3, 8, 9}	{4, 8}	{∅}	{5, 6, 9}	{5, 7, 8, 10}	{∅}

(Ex.2 - c) By construction both OSPF and OSLR have, in their routing tables all shortest paths so, except for the random choice over equivalent paths, they have the same set of routing tables (LOOK AT (Ex.1-b)).

(Ex.2 - d) The bottleneck of the OLSR protocol is the MPR set creation, in which each node must send a message to each of it's neighbor.
So, in the worst case (i.e. COMPLETE GRAPH), we have $n(n-1) = O(n^2)$ messages; so OSPF and OLSR have the same bottleneck in the worst case, but in general OLSR have better performances cause $O(n^2)$ is better than $\Theta(n^2)$.