COMP3234B Computer and Communication networks

Assignment 3 (8%)

Sample Solution

Total mark is 100.

1. (25 marks)

Answer:
There are many possible solutions. The following is an example:

(1) (**15 marks: 3 marks each)**
Subnet 0: 139.247.116.0/22
Subnet 1: 139.247.120.0/26
Subnet 2: 139.247.112.0/22
Subnet 3: 139.247.122.0/23
Subnet 4: 139.247.120.64/26

(2) (**10 marks: 1 mark per entry)**

IP address prefix	Interface
10001011 11110111 011101	0
10001011 11110111 01111000 00	1
10001011 11110111 011100	2
10001011 11110111 0111101	3
10001011 11110111 01111000 01	4

2. (23 marks) [NAT (LO2)]

Answer:

(1) (**1 mark each**)
There are many possible solutions. The following is an example:

Host A: 172.16.0.1

Interface i: 172.16.0.2
Host B: 192.168.0.1
Interface j: 192.168.0.2

(2)
Port forwarding rule installed on router 1: all requests to port 9191 should be forwarded to host A at 172.16.0.1. (**3 marks)**
Port forwarding rule installed on router 2: all requests to port 6262 should be forwarded to host B at 192.168.0.1. (**3 marks)**

(3) **(13 marks: 0.5 marks per value)**

NAT Translation Table on Router 1	
LAN side	WAN side
172.16.0.1, 2761	183.50.237.23, 8765

Request sent out from host A	
Source IP address:	172.16.0.1
Source port number:	2761
Destination IP address:	224.36.7.5
Destination port number:	6262

Request sent out from router 1	
Source IP address:	183.50.237.23
Source port number:	8765
Destination IP address:	224.36.7.5
Destination port number:	6262

Request sent out from router 2	
Source IP address:	183.50.237.23
Source port number:	8765
Destination IP address:	192.168.0.1
Destination port number:	6262

Response sent out from host B	
Source IP address:	192.168.0.1
Source port number:	6262
Destination IP address:	183.50.237.23
Destination port number:	8765

Response sent out from router 2	
Source IP address:	224.36.7.5
Source port number:	6262

Destination IP address:	183.50.237.23
Destination port number:	8765

Response sent out from router 1	
Source IP address:	224.36.7.5
Source port number:	6262
Destination IP address:	172.16.0.1
Destination port number:	2761

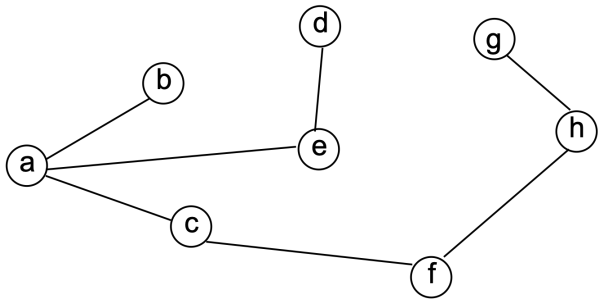
3. (23 marks) [Dijkstra's Algorithm (LO3)]

(1) (15 marks)

(12 marks on the table: deduct 0.2 marks for each wrong entry in the table)

Step	N'	D(b),p(b)	D(c),p(c)	D(d),p(d)	D(e),p(e)	D(f),p(f)	D(g),p(g)	D(h),p(h)
0	a	4, a	3, a	∞	2,a	∞	∞	∞
1	a,e	4,a	3,a	3,e		7,e	∞	9,e
2	a,e,c	4,a		3,e		6,c	∞	9,e
3	a,e,c,d	4,a				6,c	9,d	9,e
4	a,e,c,d,b					6,c	9,d	9,e
5	a,e,c,d,b,f						9,d	7,f
6	a,e,c,d,b,f,h						8,h	
7	a,e,c,d,b,f,h,g							

The shortest path tree is as follows: (3 marks on the tree: deduct 0.5 marks for each wrong edge)



(2) (8 marks)

(i) No **(1 mark)**. Link a–c needs to support 4 virtual circuits at the total data rate of 4*125Mbytes/s=4Gbps, but its capacity is only 2Gbps. **(2 marks)**

(ii) If no congestion along link a-c, a is sending to at most two nodes among c, f, h, g concurrently, as 2*125Mbytes/s=2Gbps.

The probability that a is sending data to exactly two nodes among c, f, h, g is: (4 chooses 2) 0.1^2(1-0.1)^2=0.0486 **(1 mark)**
The probability that a is sending data to exactly one node among c, f, h, g is: (4 chooses 1) 0.1* (1-0.1)^3=0.2916 **(1 mark)**
The probability that a is not sending data to any node among c, f, h, g is: (1-0.1)^4=0.6561 **(1 mark)**
The probability of no congestion along link a-c is: 0.0486+0.2916+0.6561=0.9963 **(2 marks)**

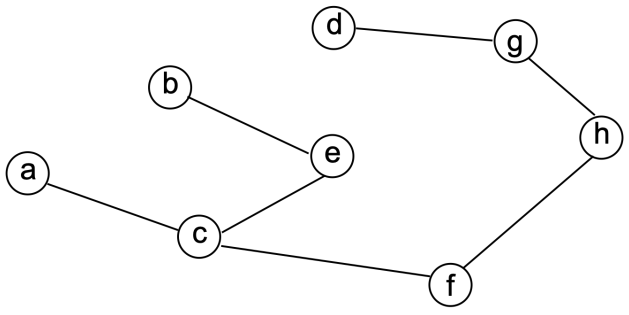
4. (16 marks) [Bellman-Ford Algorithm (LO3)]

Answer:

(13 marks on the table: deduct 0.2 marks for each incorrect entry)

Iteration	$D_b(a)$, $S_b(a)$	$D_c(a)$, $S_c(a)$	$D_d(a)$, $S_d(a)$	$D_e(a)$, $S_e(a)$	$D_f(a)$, $S_f(a)$	$D_g(a)$, $S_g(a)$	$D_h(a)$, $S_h(a)$
0	8, a	3, a	∞	∞	∞	∞	∞
1	8, a	3, a	∞	6, c	5, c	∞	∞
2	7, e	3, a	12, e	6, c	5, c	9, e	6, f
3	7, e	3, a	10, g	6, c	5, c	8, h	6, f
4	7, e	3, a	9, g	6, c	5, c	8, h	6, f

The resulting least-cost-path tree is as follows: (3 marks on the tree: deduct 0.5 marks per wrong edge)



5. (13 marks) [Hierarchical Routing in the Internet (Learning Outcomes 2, 3)]

(1) iBGP **(2 marks)**

(2) eBGP **(2 marks)**

(3) (X, i1) **(2 marks)**. i1 begins the least cost path from 2d towards the gateway

router 1c **(1 mark)**.

(4) (X, j2) **(2 marks)**. The AS path via AS1 has a smaller AS hop number than the AS path via AS2, while both j1 and j2 begin a least-cost intra-AS path leading to the closest gateway router that is connected to the NEXT-HOP of the AS path **(1 mark)**.

(5) J will be set to j1 then **(2 marks)**. AS path AS2 AS1 should be chosen, which has a smaller AS hop number than AS path AS5 AS4 AS1, and j1 begins the least-cost path to the gateway router 3a that is connected to the NEXT-HOP of this AS path **(1 mark)**.