THE UNIVERSITY OF AUCKLAND

Department of Computer Science

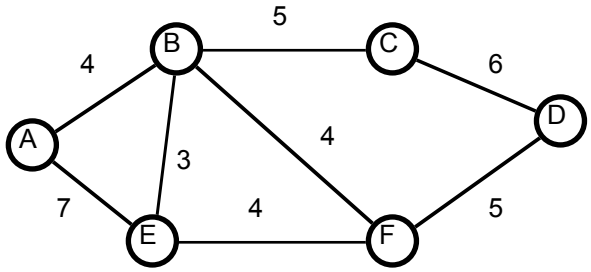
COMPSCI 314 S1 C 2004 : Assignment 4

Due Tuesday May 18 2004, 4.00 pm.

You must show working – no visible working may mean no marks.

Submit the answer on A4 paper to the correct assignment hand-in box at the Resource Centre.

Q1. Use Dijkstra's algorithm to evaluate the costs from Node A to node D in the diagram, with link costs as shown



[8 marks]

Here is the Dijkstra algorithm, set out as in the text (p495 of Ed 3).

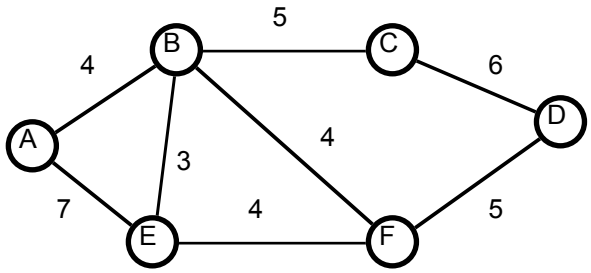
				Cost Function for					Prior function for					
Step	S	W	X	B	C	D	E	F	B	C	D	E	F	
1	A	B,E	B	4			7		A			A		
2	A,B	C,E,F	E	4	9		7	8	A	B		A/B	B	Connect E to either A or B
3	A.B.E	C,F	F	4	9		7	8	A	B		A	B	
4	A,B,E,F	C.D	C	4	9	13	7	8	A	B	F	A	B	
5	A.B.C.E.F	D	D	4	9	13	7	8	A	B	F	A	B	

At step 2 node E can be connected through either node A or node B, it doesn't matter which. All that is important is that it is included into the "connected" group of nodes, with a cost to A of 7.

8 marks, deduct 2 marks for each connection not added properly, or added in the wrong order.

Q2. Use the Bellman-Ford algorithm to compute the costs between nodes for the network below (the same as for Q 1), using the link costs shown beside each connection.

Present your results in tables similar to those of Table 7.4 on Shay p 462 2nd Ed (Table 10.5 p 498, 3rd Ed).



[10 marks]

First Iteration — Blue shows changed costs

Destination

Source	A	B	C	D	E	F
A	–	B,4			E,7	
B	A,4	–	C,5		E,3	F,4
C		B,5	–	D,6		
D			C,6	–		F,5
E	A,7	B,3			–	F,4
F		B,4		D,5	E,4	–

Second Iteration

Destination

Source	A	B	C	D	E	F
A	–	B,4	B,9		E,7	B,8
B	A,4	–	C,5	F,9	E,3	F,4
C	B,9	B,5	–	D,6	B,8	B,9
D		F,9	C,6	–	F,9	F,5
E	A,7	B,3	B,8	F,9	–	F,4
F	B,8	B,4	B,9	D,5	E,4	–

Third Iteration

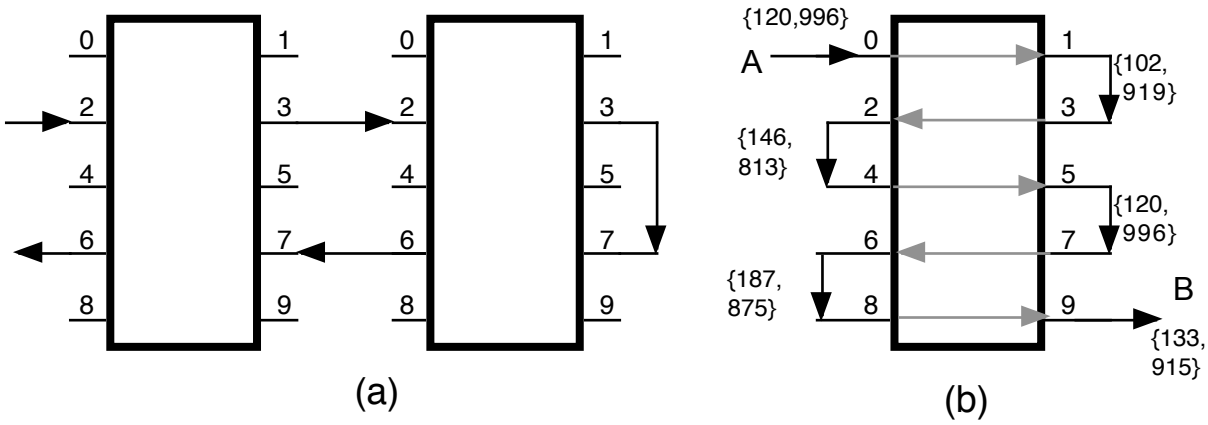
Destination

Source	A	B	C	D	E	F
A	–	B,4	B,9	B,13	E,7	B,8
B	A,4	–	C,5	F,9	E,3	F,4
C	B,9	B,5	–	D,6	B,8	B,9
D	F,13	F,9	C,6	–	F,9	F,5
E	A,7	B,3	B,8	F,9	–	F,4
F	B,8	B,4	B,9	D,5	E,4	–

There is no change on the fourth and later iterations

5 marks first table, 3 second, 2 for 3rd. -0.5 mark for each error, -1 if no termination stated

Q3. When testing networks and network components it is often useful to "loopback" a connection so that a given circuit goes through a switch several times, as in (a) below, or even (b). One advantage is that it allows all testing to be done at one end.



The remainder of this question uses diagram (b).

Each link shows two virtual circuit numbers, the first for data travelling in the direction of the arrows (from A to B) and the second for data travelling in the reverse direction (from B to A).

The diagram should have been drawn connecting ports 0 to 1, 3 to 2, etc as in the grey additions to the diagram above

(i) What is the virtual circuit number of messages from A when received at B? **[1 mark]**

133

(ii) What is the virtual circuit number of messages from B when received at A? **[1 mark]**

996

(iii) Construct the routing tables to implement the connections shown. **[8 marks]**

Input Port	Input VC	Output	Output VC	Rev VC
0	120	1	102	996
1	919	0	996	102
2	813	3	919	146
3	102	2	146	919
4	146	5	120	813
5	996	4	813	120
6	875	7	996	187
7	120	6	187	996
8	187	9	133	875
9	915	8	875	133

8 marks, –1 mark for each row in error ("Rev VC" column is not necessary)

(iv) How must the routing tables be changed to connect directly between ports 0 and 5, bypassing ports 1, 2, 3 and 4? **[2 marks]**

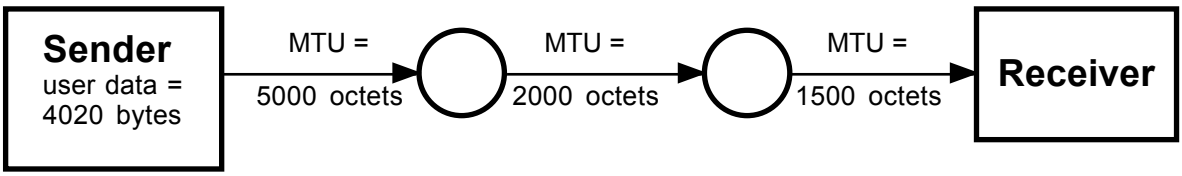
Input Port	Input VC	Output	Output VC	Rev VC
0	120	**5**	**120**	996
5	996	**0**	**996**	120
6	875	7	996	187
7	120	6	187	996
8	187	9	133	875
9	915	8	875	133

The changed values are shown in underlined bold; connections to Ports 1, 2, 3, 4 are removed here, but no error if they are left.

1 mark for each correct pair {output port, VC num} **[2 marks]** **[12 marks]**

Q4. A user record of 4020 bytes (4000 data + 20 IP header) is transmitted over a TCP/IPv4 link as below. (The 4000 bytes includes any TCP header.) Show the IPv4 fragments that arrive at the receiver, giving appropriate values for all quantities concerned with fragmentation and reassembly.

Include the IPv4 headers in your calculation, but not any TCP or similar header.



[10 marks]

Assume any value at all for IDENTIFICATION, say 9876 — it is copied into all packets.
The initial "description" , "packet number" and "Payload Length" fields are useful, but not needed.

Description	Packet number	Identification	Payload Length	Total Length	Fragment Offset Val	More Frag
Initial packet, NOT fragmented	1A	9876	4000	4020	0	0
First switch splits for MTU = 2000	2A	9876	1976	1996	0	1
	2B	9876	1976	1996	247	1
	2C	9876	48	68	494	0
Second switch splits first two packets						
First fragment of 2A	3A	9876	1480	1500	0	1
Second fragment of 2A	3B	9876	496	516	185	1
First fragment of 2B	3C	9876	1480	1500	247	1
Second fragment of 2B	3D	9876	496	516	432	1
Fragment 2C copied without change		9876	48	68	494	0

1 mark for each of IDENTIFICATION, (total) LENGTH, OFFSET and More Frags columns 4 marks
1 mark for correct values in each of the 5 final received packets 5 marks
1 mark for reasonable description of what is happening 1 mark
"What is happening" includes describing the packets over the first two links (–1 mark if not shown)

TOTAL = 40 marks