CC0221

THE UNIVERSITY OF SYDNEY
FACULTY OF ENGINEERING AND INFORMATION TECHNOLOGIES
School of Information Technologies
COMP2121 Distributed Systems and Network Principles
Final Examination
CONFIDENTIAL[1]
Semester 2, 2016
Time allowed: **48 minutes (+ 4 minutes reading time)**

Please fill in the form below

Seat Number:
Last/Family Name:
First/Given Name:
SID:
Signature:

Office use only

Exercise	Marks
1	/16
2	/10

This is a closed book examination, but you are permitted to use one A4 sheet of paper with notes (handwritten or printed). Write your final answers in the provided spaces in this booklet. *Answer all questions using a blue or black pen. Writing in pencil is not considered to be an answer and will be ignored.* The marks sum up to 100. Please check that this examination paper has 5 pages.

Exercise 1 /16pts

Q 1.1 /3pts

Complete the following definition. The happens-before relation "a happens before b", denoted by a $\rightarrow$ b if:

Answer:

- a and b are events from the same process such that a occurs before b,
- if a is the event of a message being sent by one process and b is the event of the same message being received by another process or

[1]Confidential: This paper is not to be taken from the examination room

- it exists some event c such that a $\rightarrow$ c and c $\rightarrow$ b (i.e., transitive closure)

Points: 1 point per item of the definition.

Q 1.2 /3pts

Let VC(a) and VC(b) be the vector clock value, C(a) and C(b) be the logical clock value chosen for events a and b. For each statements below, say whether it is True (T) or False (F)

- VC(a) $<$ VC(b) if and only if a $\rightarrow$ b

  Answer: True

- C(a) $<$ C(b) if and only if a $\rightarrow$ b

  Answer: False

- If a $\rightarrow$ b then C(a) $<$ C(b)

  Answer: True

Q 1.3 /6pts

Consider the distributed execution represented in Figure 1. Indicate the vector clock associated with each event.

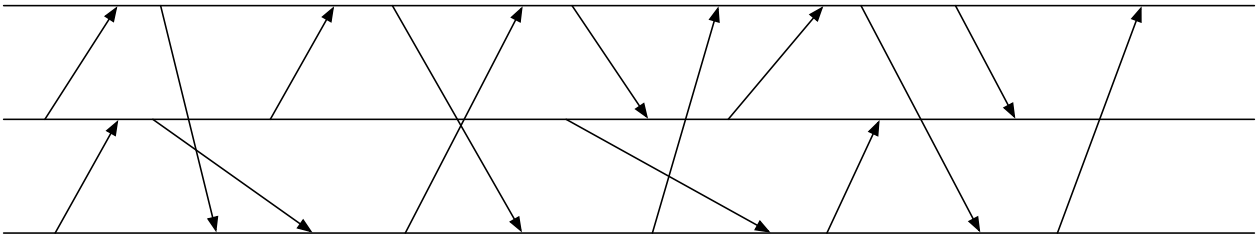

Figure 1: Vector clock

Answer: The Figure 2 indicates the correct clock values.

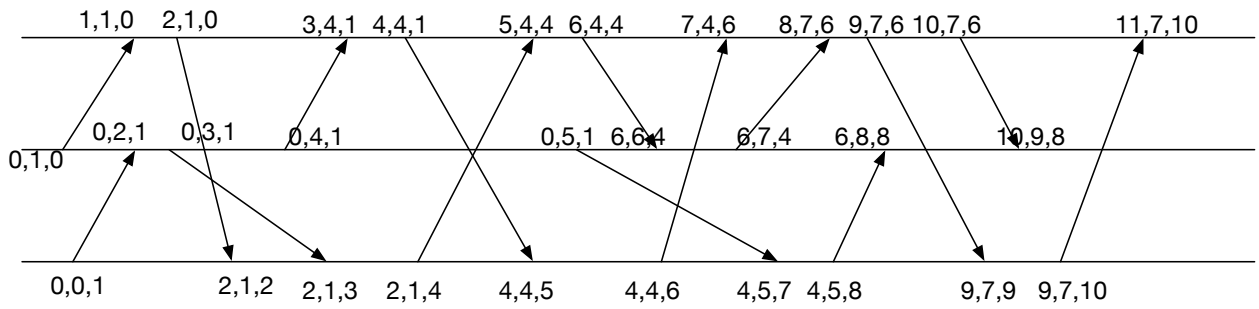

Figure 2: Vector clock Solution

Points$= min(6, \lfloor \frac{c}{5} \rfloor)$ *where c if the number of correct values.*

Q 1.4 /4pts

What are the two main classes of routing protocols/algorithms seen in this course? Explain briefly their differences

Answer: The protocols seen in the course are

- Distance-vector: neighbours exchange their routing table
- Link-state: neighbours only exchange connectivity information

Points: 1 point per name of routing algorithm and 1 point per brief explanation.

Exercise 2 /10pts

Q 2.1 /4pts

Draw the final routing tables of each node obtained with RIP on the communication graph depicted in Figure 3 where the label on each edge is its identifier and each node represents a process.

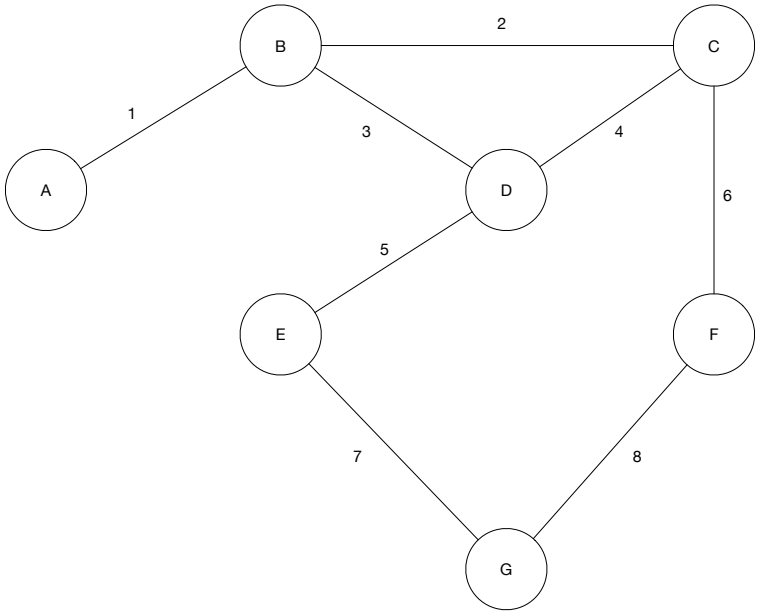

Figure 3: A communication graph

Answer: Here are the routing tables:

Table of E

Dest	Dir	Cost
E	local	0
C	5	2
D	5	1
B	5	2
A	5	3
F	7	2
G	7	1

Table of C

Dest	Dir	Cost
E	4	2
C	local	0
D	4	1
B	2	1
A	2	2
F	6	1
G	6	2

Table of D

Dest	Dir	Cost
E	5	1
C	4	1
D	local	0
B	3	1
A	3	2
F	5	1
G	5	2

Table of B

Dest	Dir	Cost
E	3	2
C	2	1
D	3	1
B	local	0
A	1	1
F	3	2
G	3	3

Table of A

Dest	Dir	Cost
E	1	3
C	1	2
D	1	2
B	1	1
A	local	0
F	1	3
G	1	4

Table of F

Dest	Dir	Cost
E	8	2
C	6	1
D	6	2
B	6	2
A	6	3
F	local	0
G	8	1

Table of G

Dest	Dir	Cost
E	7	1
C	8	2
D	7	2
B	7	3
A	7	4
F	8	1
G	local	0

points=$\lfloor \frac{2c}{5} \rfloor$ *where c is the number of correct table lines*

Q 2.2 /6pts

Consider now the same graph where each edge has a second label indicating the cost of traversing the corresponding link, as depicted in Figure 4, and considered the Dijkstra algorithm able to route though the less costly link to the destination. Draw the final routing tables of each node in this case.

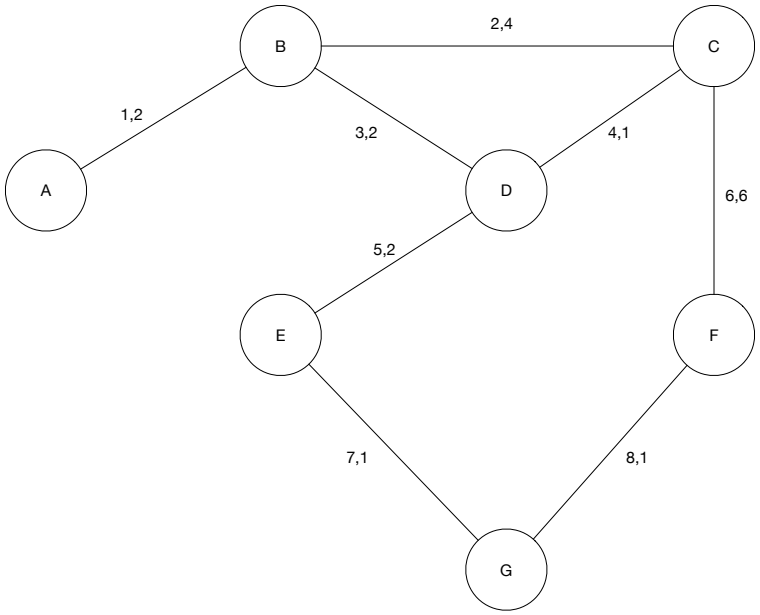

Figure 4: A weighted communication graph

Answer: Here are the routing tables:

Table of E

Dest	L	D
E	local	0
C	D→C	3
D	E→D	2
B	D→B	4
A	B→A	5
F	F→F	2
G	E→G	1

Table of C

Dest	L	D
E	D→E	3
C	local	0
D	C→D	1
B	D→B	3
A	B→A	5
F	G→F	5
G	E→G	4

Table of D

Dest	L	D
E	D→E	2
C	D→C	1
D	local	0
B	D→B	2
A	B→A	3
F	G→F	4
G	E→G	3

Table of B

Dest	L	D
E	D→E	4
C	D→C	3
D	B→D	2
B	local	0
A	B→A	2
F	G→F	6
G	E→G	5

Table of A

Dest	L	D
E	D→E	6
C	D→C	5
D	B→D	4
B	A→B	2
A	local	0
F	G→F	8
G	E→G	7

Table of F

Dest	L	D
E	G→E	2
C	D→C	5
D	E→D	4
B	D→B	6
A	B→A	8
F	local	0
G	B→A	1

Table of G

Dest	L	D
E	G→E	1
C	D→C	4
D	E→D	3
B	D→B	5
A	B→A	7
F	G→A	1
G	local	0

points= $\lfloor \frac{6c}{25} \rfloor$ *where c is the number of correct table lines*