COL733 Quiz 2

Viraj Agashe

TOTAL POINTS

10 / 10

QUESTION 1

1 Ques 1 1.75 / 1.75

+ 0 pts Incorrect

✓ + 0.25 pts *1010*

✓ + 0.25 pts *2010*

✓ + 0.25 pts *2110*

✓ + 0.25 pts *2111*

✓ + 0.25 pts *2112*

✓ + 0.25 pts *2122*

✓ + 0.25 pts *2123*

QUESTION 2

2 Ques 2 1.5 / 1.5

+ 0 pts Incorrect

✓ + 0.25 pts *2000*

✓ + 0.25 pts *1010*

✓ + 0.25 pts *1120*

✓ + 0.25 pts *2001*

✓ + 0.25 pts *2102*

✓ + 0.25 pts *2103*

QUESTION 3

3 Ques 3 0.5 / 0.5

+ 0 pts Incorrect

✓ + 0.1 pts *a=3*

✓ + 0.1 pts *b=4*

✓ + 0.1 pts *M-A=N-A=M-B=N-B = [ ]*

✓ + 0.1 pts *mcursor=2*

✓ + 0.1 pts *ncursor=1*

QUESTION 4

4 Ques 4 1.25 / 1.25

+ 0 pts Incorrect

✓ + 0.1 pts *mcursor=2*

✓ + 0.1 pts *ncursor=1*

✓ + 0.1 pts *a=3*

✓ + 0.25 pts *M-A=N-A = []*

✓ + 0.2 pts *b=0*

✓ + 0.25 pts *M-B=["b": 2, "b": 1]*

✓ + 0.25 pts *N-B=["b":1]*

QUESTION 5

5 Ques 5 2.5 / 2.5

+ 0 pts Incorrect

✓ + 0.5 pts *Yes. It is consistent*

✓ + 0.5 pts *Straight line time of 2120*

✓ + 0.75 pts *Before straight line: 2 events for M, 1 event for N, 2 events for A*

✓ + 0.75 pts *After straight line: 3 events for B*

QUESTION 6

6 Ques 6 2.5 / 2.5

+ 0 pts Incorrect / no explanation

✓ + 1 pts *False*

✓ + 1.5 pts *Message from N->A goes backwards*

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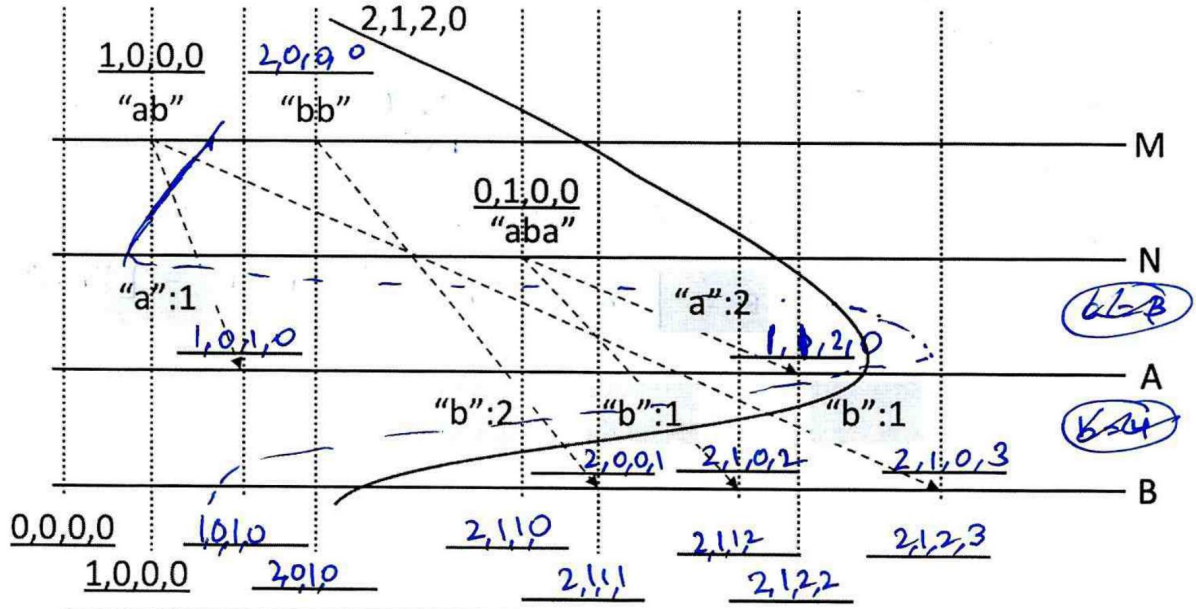
Consider the following event timeline. There are a total of 4 processes in the system: M, N, A, and B. M received two tweets: "ab" and "bb" and N received one tweet: "aba". M sent one message to A "a": 1 and two messages to B "b": 1 and "b": 2. N sent one message to A "a": 2 and one message to B "b": 1.



M	mcursor=0
N	ncursor=0
A	a = 0; M-A = [ ]; N-A = [ ]
B	b = 0; M-B = [ ]; N-B = [ ]

Global state at 0,0,0,0

M	mcursor= 2
N	ncursor= 1
A	a = 3 ; M-A = [ ] ; N-A = [ ]
B	b = 4 ; M-B = [ ] ; N-B = [ ]

Global state at 2,1,2,3

Q1: [1.75 marks] *A hypothetical external observer having full access to every process could maintain a global vector clock. This global vector clock advances the process P_i's component when P_i sees an event like sending or receiving a message. We have already filled two global vector timestamps: 0,0,0,0, and 1,0,0,0. Please fill the remaining 7 entries with their global vector timestamps in the diagram above.*

Q2: [1.5 marks] *The processes cannot "see" the global vector timestamps. So, they approximate the global vector timestamps as discussed in the class. We have already filled two local vector timestamps for process M and for process N: 1,0,0,0 and 0,1,0,0 respectively. Please fill the remaining 6 entries with their local vector timestamps in the diagram above.*

Q3: ***[0.5 marks]*** *We also show the initial state i.e, at global vector timestamp 0,0,0,0, of all the processes and channels. Please fill the final state of all the processes and channels at global vector timestamp 2,1,2,3 in the diagram above.*

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Q4: [1.25 marks] *Recall that a checkpoint cuts the event timeline into past (in-the-checkpoint) and future (not-in-the-checkpoint). A checkpoint cut can also be represented by a vector timestamp. For example, the diagram shows a checkpoint cut at global vector timestamp 2,1,2,0. Show the state of all the processes and channels at 2,1,2,0.*

mcursor = 2

ncursor = 1

a = 3 M-A = [ ] N-A = [ ]

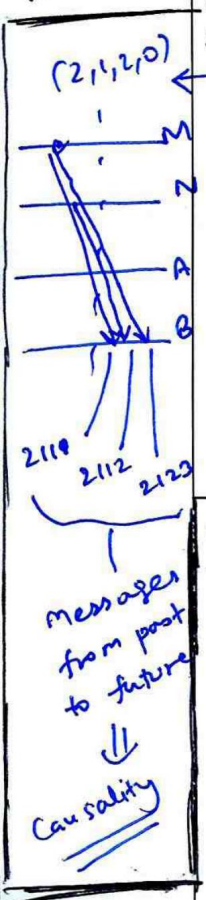
~~b = 2 M-B = ["b:2","b:1"] N-B = ["b:1"]~~

b = 0 M-B = ["b:2", "b:1"] N-B = ["b:1"]

Q5: [2.5 marks] *From your answer of Q1, notice that 2,1,2,0 was never a global vector timestamp. Is the state in 2,1,2,0 that you showed in Q4 a consistent checkpoint? Justify your answer.*

Hint: For consistent checkpoints, it is possible to redraw the event timeline by stretching and compressing timelines like a rubber band while maintaining causality such that the checkpoint cut comes up as a straight line, i.e, the cut's vector timestamp appears as a global vector timestamp.

for Q5

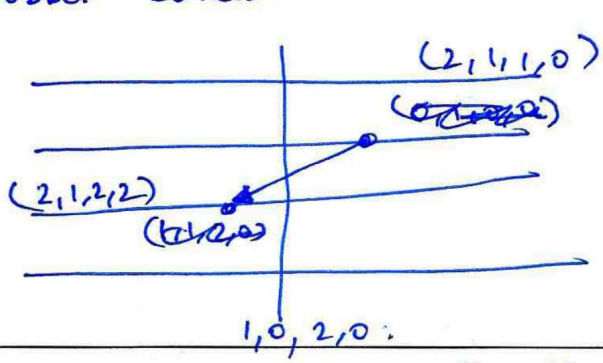


Yes., the state in 2,1,2,0 is a consistent checkpoint, as causality is maintained (messages are from past → future). If we crash, and recover, we will have: M-B = [b:2, b:1] & N-B: [b:1] messages pending which when we recover & proceed will make b = 4, and a = 3 as already in the checkpoint.

↳ Consistent final state.

Q6 [2.5 marks]: *True or false. A checkpoint cut at 1,0,2,0 gives a consistent checkpoint. Justify your answer.*

No. 1,0,2,0 is NOT. consistent, since if we draw the rubber bands:



This will lead to double counting ⇒ Inconsistent final state.

for Q6

There is a message from global time (2,1,1,0) to (2,1,2,2) but they are on opposite side of checkpoint boundary.

↳ Therefore causality is violated. If we crash, A will have already incremented count of a, but will recv. another message.