1. A clock is reading 11:34:26.0 (hr:min:sec) when it is discovered to be 6 seconds fast. Explain why it is undesirable to set it back to the right time at that point, and show (numerically) how it should be adjusted so as to be correct after 12 seconds have elapsed. page 616

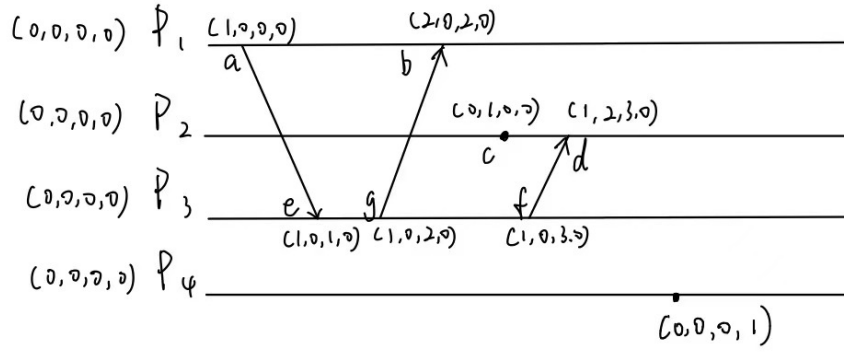
   Because there might be other machines that set their time according to this clock. If we set this clock to the right time, then other clocks that refer to this clock would not be synchronous with this clock.
   The current time is 11:34:20.0, in order to adjust this clock to be correct after 12 seconds, the clock should point to 11:34:32.0 after 12 seconds from now. So the second hand of the clock should move 6 units after 12 seconds, that is, the second hand of this clock should move 1 unit every second in this 12 second. And after 12 seconds, the clock should go back to normal.

2. A client attempts to synchronize with a time server. It records the round-trip times and timestamps returned by the server in the table below. Which of these times should it use to set its clock? To what time should it set it?
   Estimate the accuracy of the setting with respect to the server's clock. If it is known that the time between sending and receiving a message in the system concerned is at least 8 ms, do your answers change?

Round-trip (ms)	*Time (hr:min:sec)*
22	*10:54:23.674*
25	*10:54:25.450*
20	*10:54:28.342*

   We should choose the minimum round-trip time which is 20ms.
   So the time for one trip is 20 / 2 = 10ms
   The time to arrive at the server is 10:54:28.342 + 10ms = 10:54:28:352, therefore the clock should be set to 10:54:28:352.
   The accuracy of the setting is ±10ms.
   If the transmission time is at least 8 ms, then the time setting is the same, but the accuracy is updated to 2ms.

3. a)



a: (1,0,0,0) b: (2,0,2,0)
c: (0,1,0,0) d: (1,2,3,0)
e: (1,0,1,0) f: (1,0,3,0)
g: (1,0,2,0) h: (0,0,0,1)

b)
The timestamp of event d is (1,2,3,0)
If there are other events that have at least one value less than the value in the same dimension, and at least one value is larger than the value in the same dimension, then these events are concurrent with event d.
Therefore, event b(2,0,2,0) and event h(0,0,0,1) are concurrent with event d.

4.

a)
transmission time:
6:22:15.250 - 6:22:15.100 = 150ms
averaged one-way transmission time:
150 / 2 = 75ms
so we should set the client's clock at:
6:21:10.700 + 75ms = 6:21:10.775

b)
averaged one-way error: (150 - 124) / 2 = 13ms
So the error is ±13ms

5.

Before the channel between P and Q is created:

1) P recorded its state as 101
2) P sends a marker message to Q
3) Q receives the marker message, records its state as 102
4) Q records the channel as an empty set{}
5) Q turns on recording of messages arriving over other incoming channels
6) Q sends marker
7) P receives marker
8) P records the channel to communicate with Q as an empty set{}

After the channel from P to Q is created:

1) P sends a message to Q
2) Q receives the message, and records it in the state

After the channel from Q to P is created:

1) Q sends a message to P
2) P receives the message, and records it in the state