มหาวิทยาลัยสงขลานครินทร์
คณะวิศวกรรมศาสตร์

สอบปลายภาค: ภาคการศึกษาที่ 2 **ปีการศึกษา**: 2553

วันที่สอบ: 2 มีนาคม 2554 **เวลาสอบ**: 13.30 – 16.30 น.

รหัสวิชา: 241-422 **ห้องสอบ**: ห้องหัวหุ่นยนต์

ชื่อวิชา: COMPUTER GRAPHICS SYSTEMS ENGINEERING MODELLING AND SIMULATION (กราฟิกส์คอมพิวเตอร์แอนิเมชัน วิศวกรรมระบบการจำลองแบบ และการจำลองสถานการณ์)

ผู้ออกข้อสอบ: ผศ.ดร.พิชญา ตัณฑัยย์

คำสั่ง: อ่านรายละเอียดของข้อสอบ และคำแนะนำให้เข้าใจก่อนเริ่มทำข้อสอบ

อนุญาต: เครื่องเขียนต่างๆ เช่น ปากกา หรือดินสอ เอกสารประกอบการสอน (สไลด์) พจนานุกรม รวมทั้งแบบอิเล็กทรอนิกส์ เครื่องคิดเลข

ไม่อนุญาต: หนังสือ โทรศัพท์ อุปกรณ์สื่อสารทุกชนิด

เวลา: 3 ชั่วโมง (180 นาที)

คำแนะนำ

- ข้อสอบมี 16 หน้า (รวมใบปะหน้า) 11 ข้อใหญ่ คะแนนรวม 140 คะแนน (20%) ให้ทำทุกข้อ
- คำตอบส่วนใดอ่านไม่ออก จะถือว่าคำตอบนั้นผิด
- อ่านคำสั่งในแต่ละข้อให้เข้าใจก่อนลงมือทำ
- อย่าลืม เขียน ชื่อ-นามสกุล และรหัสนักศึกษา ลงในข้อสอบทุกแผ่น
- ตอบเป็นภาษาไทย
- **ทุจริตในการสอบมีโทษขั้นต่ำปรับตกในรายวิชานั้นและพักการเรียน 1 ภาคการศึกษา โทษสูงสุดให้ออก**

1	2	3	4	5	6	7	8	9	10	11	Total	Collected
42	6	12	10	10	10	10	10	10	10	10	140	20

Question 1 (42 marks; 45 minutes)

a) Why is time so important in a simulation? (2 marks)

b) What are the differences between *event-driven simulation* and *time-driven simulation* frameworks? (2 marks)

c) Give at least 4 benefits of distributed simulation. (2 marks)

d) What are the differences between *virtual environments* and *analytic simulations*? (4 marks)

Issue	Analytic Simulations	Virtual Environments
Typical objective		
Execution pacing		
Human interaction		
Accuracy		

e) Give examples of *simulation time*, *physical time* and *wallclock time*. (3 marks)

f) What are the differences between *real-time* and *as-fast-as-possible* modes of execution? (2 marks)

g) What are the differences between *simulation executive* and *simulation application*? (4 marks)

h) What are the advantages of the *publish-and-subscribe* mechanism used in distributed simulation? (2 marks)

i) What is a *callback* function? (1 marks)

j) What are the differences between *dynamic* and *static* data distribution? (4 marks)

k) Why does data distribution prefer *region* to *point*? (1 marks)

l) What are the differences between *push* and *pull* clock synchronization algorithms using a central time server? (2 marks)

m) What does the *Lower Bound on the Time Stamp* guarantee? (1 marks)

n) What does a null message contain? And how can the null message algorithm help with deadlock avoidance? (2 marks)

o) How *lookahead* can speed up a parallel and distributed simulation? What can *lookahead* be derived from? (4 marks)

p) Give examples of how *livelock* and *deadlock* can occur? (2 marks)

deadlock	livelock

q) What is a distance matrix and what is it for? (2 marks)

Question 2 (8 marks; 10 minutes)

a) If we would like the simulation to run 5-time slower in synchrony with an equivalent advance in wallclock time, what is the required scaling factor and the transfer equation of the simulation time and wallclock time.

(2 marks)

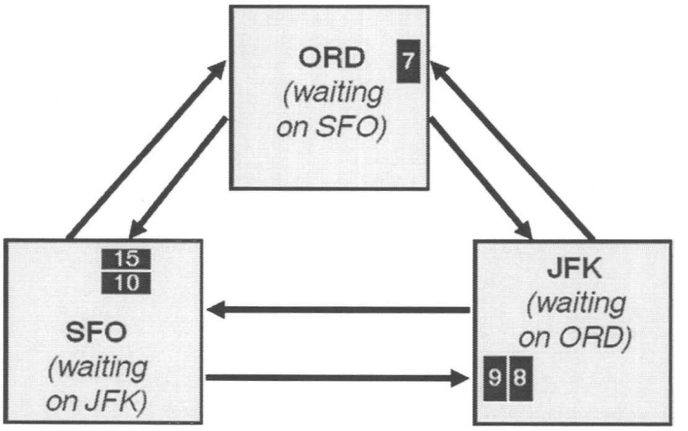
_____

_____

_____

_____

b) From the following topology of simulation nodes which has been globally deadlocked, if the current simulation time at SFO is 2 and the lookahead is 1 for all links, demonstrate how the null message algorithm break the deadlock. Also inform how many null messages needed to be sent in order to break the deadlock. (6 marks)

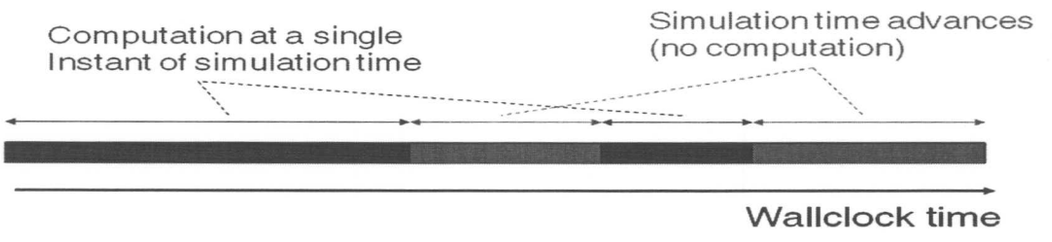


_____null messages are needed.

Question 3 (12 marks; 15 minutes)

From the following process-oriented program, the landing time, R, is 1, the time taken on the ground, G, is 2, the time to take off, D, is 1. The airplanes F1 and F2 are scheduled to arrive at 1 time unit and 3 time units consecutively. Demonstrate the changes of global state variables and how both aircraft processes advance in simulation time, for example, alternately suspend (idle) and resume (computing) due to the primitive functions (WaitUntil and AdvanceTime).

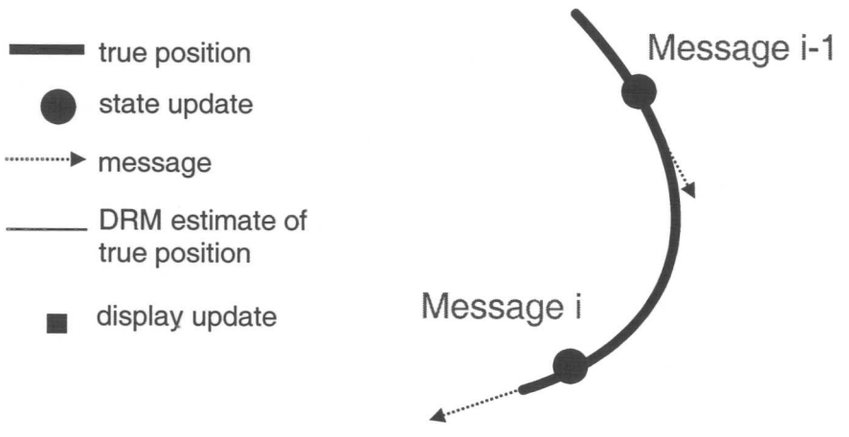
```
/* simulate aircraft arrival, circling, and landing */
Integer: InTheAir;
Integer: OnTheGround;
Boolean: RunwayFree;
1       InTheAir := InTheAir + 1;
2       WaitUntil (RunwayFree);          /* circle */
3       RunwayFree := FALSE;             /* land */
4       AdvanceTime(R);
5       RunwayFree := TRUE;
        /* simulate aircraft on the ground */
6       InTheAir := InTheAir - 1;
7       OnTheGround := OnTheGround + 1;
8       AdvanceTime(G);
        /* simulate aircraft departure */
9       WaitUntil (RunwayFree);
10      RunwayFree := FALSE;
11      AdvanceTime(D);
12      OnTheGround := OnTheGround - 1;
13      RunwayFree := True;
```



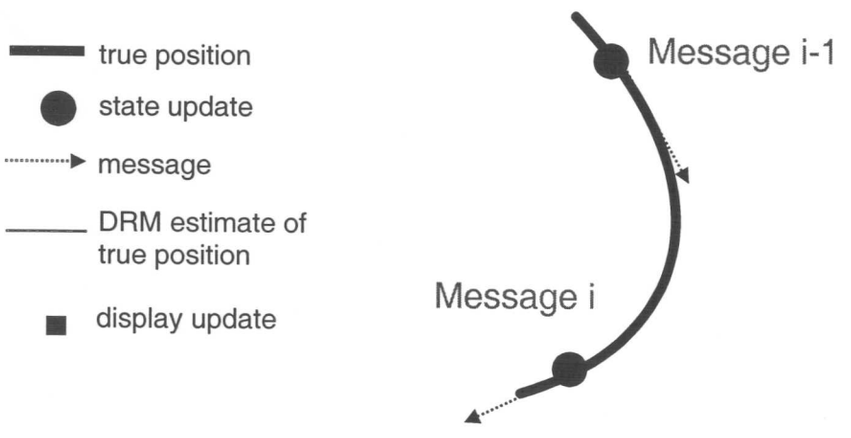
Question 4 (10 marks; 10 minutes)

From the following disjointed graph below, show how *time compensation* and *smoothing* algorithms change the display.

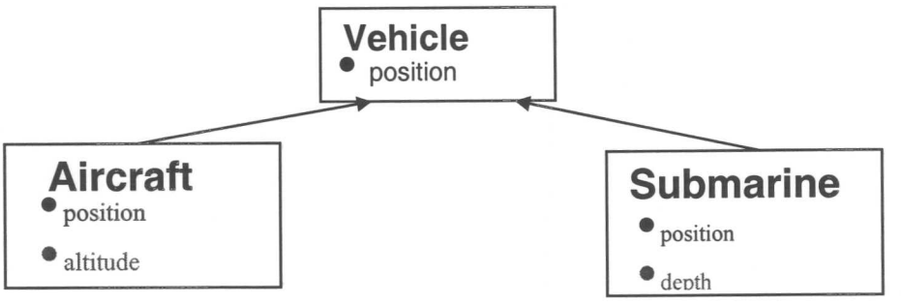
a) Time Compensation (5 marks)



b) Smoothing (5 marks)



Question 5 (10 marks; 10 minutes)



From the above diagram,

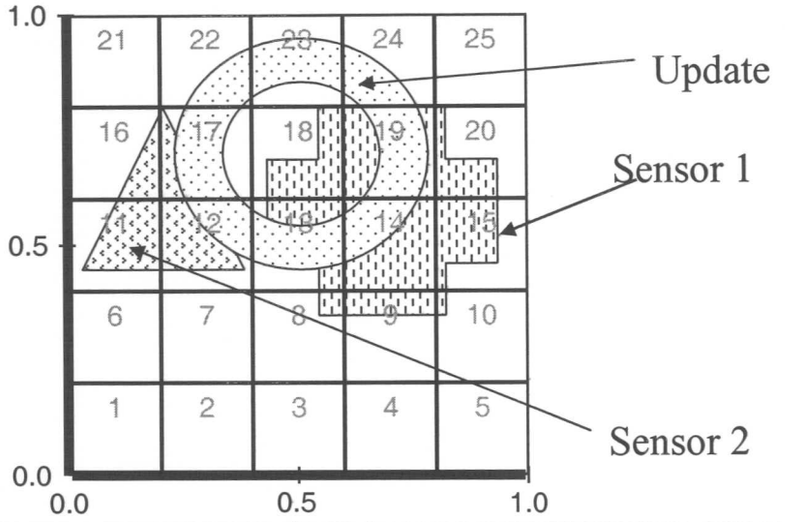
a) add class *Ship* and *Truck* into the diagram. (2 marks)

b) explain how other federates can receive updates from the newly added class. (4 marks)

c) list possible expressions from the name space after adding class *Ship* and *Truck*. (4 marks)

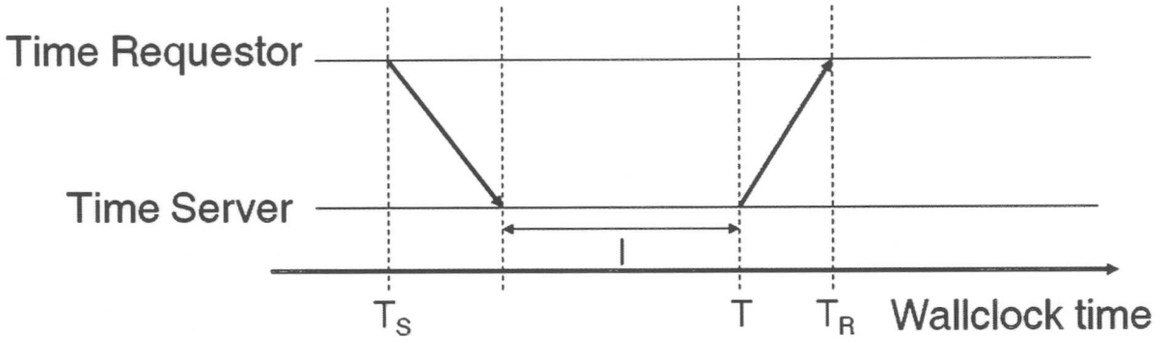
Question 6 (10 marks; 10 minutes)

From the following picture, show *duplicate* and *unwanted* updates at Sensor 1 and Sensor 2.



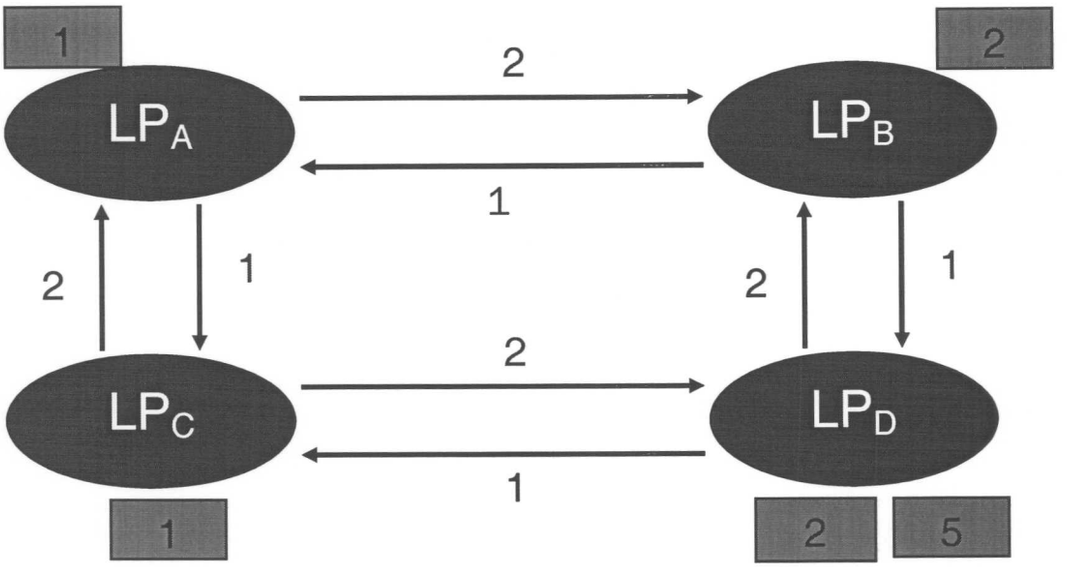
Question 7 (10 marks; 10 minutes)

a) According to the Network Time Protocol Latency and Offset Estimation, explain how to find offset between clocks. (6 marks)



b) Suppose that the clock is 5 milliseconds ahead, interrupt generated every 10 milliseconds, explain what to do when re-synchronizing clocks. (4 marks)

Question 8 (10 marks; 10 minutes)



a) From the above topology, fill in the following distance matrix.

(4 marks)

	A	B	C	D
A				
B				
C				
D				

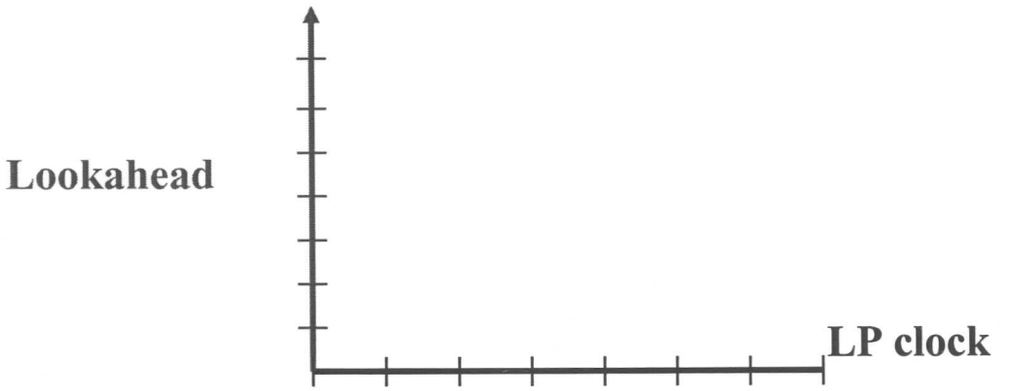
b) Calculate the Lower Bound on the Timestamp (LBTS) on each logical process. (4 marks)

A	
B	
C	
D	

c) Which messages do depend on which? (2 marks)

Question 9 (10 marks; 10 minutes)

If a logical process is at simulation time 2 and *lookahead* is 4, use the below graph to help with answering the following questions.



a) Complete the above graph to show the lookahead and guaranteed time of next megssages. (4 marks)

b) The logical process has promised subsequent messages will have a time stamp of at least _____. (2 marks)

c) If *lookahead* were to increase to 6, what should be done? (2 marks)

_____

_____

_____

_____

_____

d) If *lookahead* were to decrease to 2, what should be done? (2 marks)

_____

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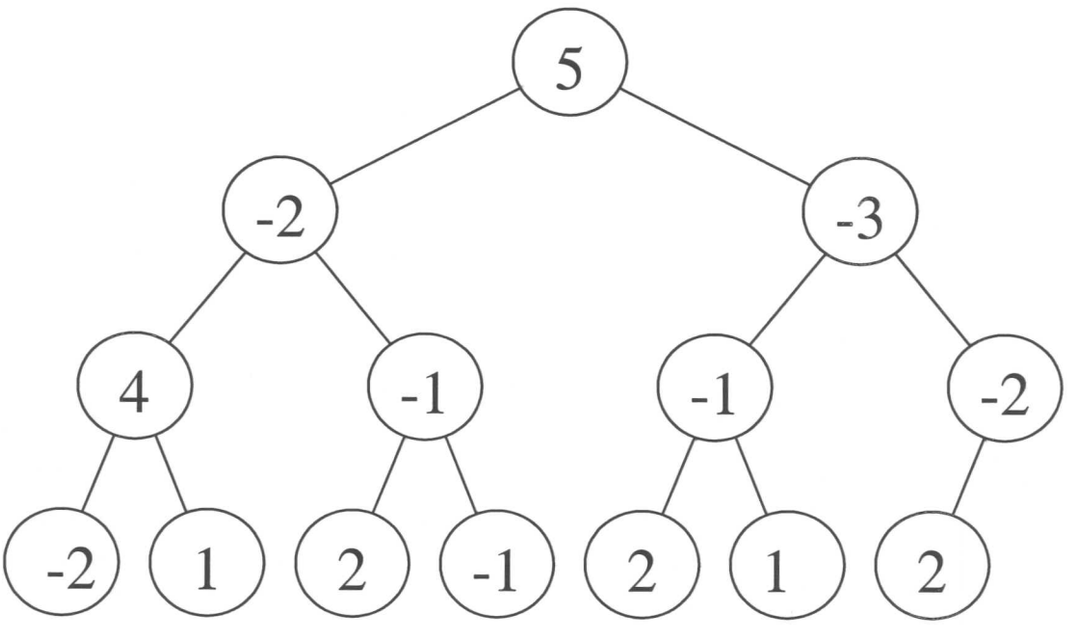
Question 10 (10 marks; 10 minutes)

From the message counters in the following topologies of logical processes, use the Flush Barrier to demonstrate if there are transient messages and how many.?

a) Tree (5 marks)



There are _____ transient messages.

b) Butterfly (5 marks)

There are _____ transient messages.

Question 11 (10 marks; 10 minutes)

Explain the concept of deadlock detection by Diffusing Computations (Dijkstra/Scholten). Demonstrate an example of the implementation briefly.

----End of Examination----

"Live a real life, don't emulate it."

Pichaya Tandayya Lecturer