PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Final Examination: Semester 2 **Academic Year**: 2008

Date: 21 December 2008 **Time** 9.00-12.00 (3 hours)

Subject Number: 240-631 **Room**: A201

Subject Title: Parallel and Distributed Simulation Systems

Exam Duration: 3 hours

This paper has 10 pages, 10 questions and 100 marks (30%).

Authorised Materials:

- Writing instruments (e.g. pens, pencils).
- Textbooks, a notebook, handouts, and dictionaries are permitted.

Instructions to Students:

- Scan all the questions before answering so that you can manage your time better.
- Attempt all questions in Thai.
- Write your name and ID on every page.
- Any unreadable parts will be considered wrong.

When drawing diagrams or coding, use good layout, and short comments; marks will not be deducted for minor syntax errors.

NO	Time (Min)	Marks	Collected	NO	Time (Min)	Marks	Collected
1	30	25		6	10	10	
2	10	5		7	20	10	
3	20	10		8	20	10	
4	20	10		9	10	10	
5	10	10		Total	180	100	

Cheating in this examination

Lowest punishment: Failed in this subject and courses dropped for next semester.

Highest punishment: Expelled.

Name_____ ID_____

Question 1 (25 marks; 30 minutes)

a) What is a simulation? (2 marks)

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

c) What is parallel or distributed simulation and what are the benefits? (3 marks)

How do multiprocessors share their memory? (1 marks)

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

Name_____ ID_____

e) Compare *broadcast* and *publish-and-subscribe* mechanism of message passing. (4 marks)

f) What is a *callback* function? (2 marks)

g) What are the differences between *dynamic* and *static* data distribution? (2 marks)

h) Why does data distribution prefer *region* to *point*? (2 marks)

i) What are the differences between *push/pull* and *centralized/distributed* clock synchronization algorithms? (4 marks)

Question 2 (5 marks; 5 minutes)

If we would like the simulation to run 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.

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Question 3 (10 marks; 20 minutes)

From the following process program, show the relationship between state variables and time when R = 3 and G = 3, and airplanes F1 and F2 are scheduled to arrive at 1 time unit and 2 time units consecutively.

```
/* 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       OnTheGround := OnTheGround - 1;
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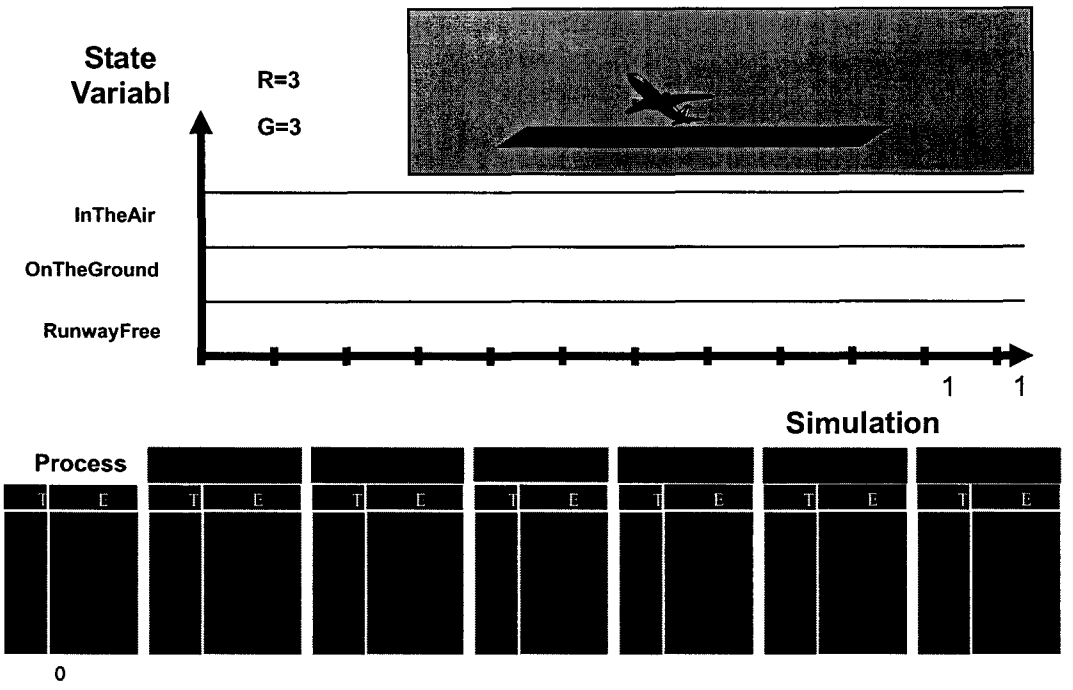
Name_____ ID_____

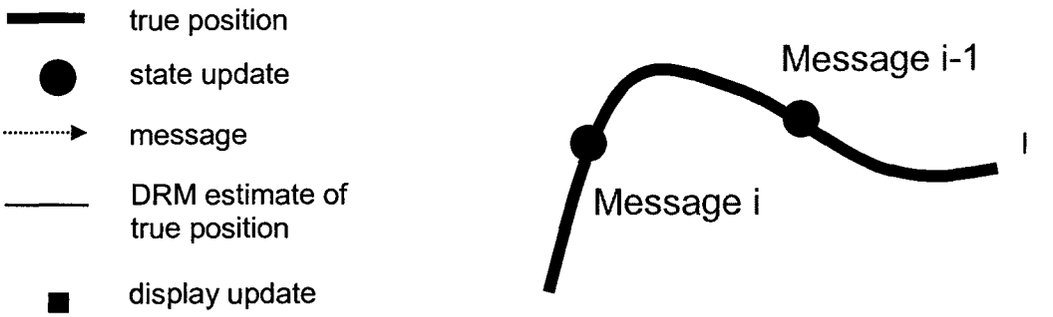

State
Variabl
R=3
G=3
InTheAir
OnTheGround
RunwayFree
1
1
Simulation
Process
T
E
0

Name_____ ID_____

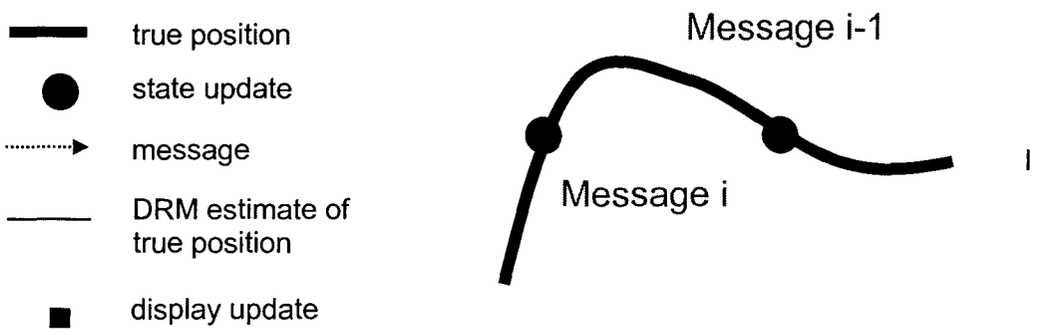
Question 4 (10 marks; 20 minutes)

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

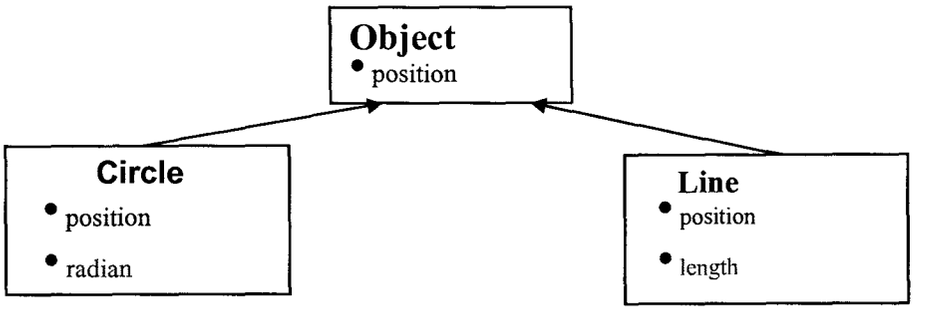
a) Time Compensation (1 mark)



b) Smoothing



Question 5 (10 marks; 10 minutes)



From the above diagram,

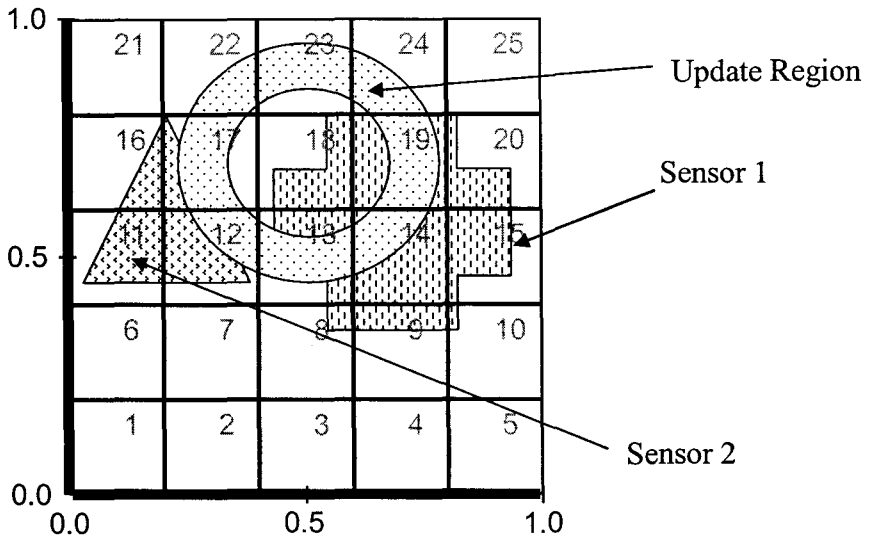
a) add class *Sphere* into the diagram.

b) explain how other federates can receive updates from the newly added class even though the added class was not in the publication information. Use class *Sphere* in a) as an example.

b) list possible expressions from the name space.

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; 20 minutes)

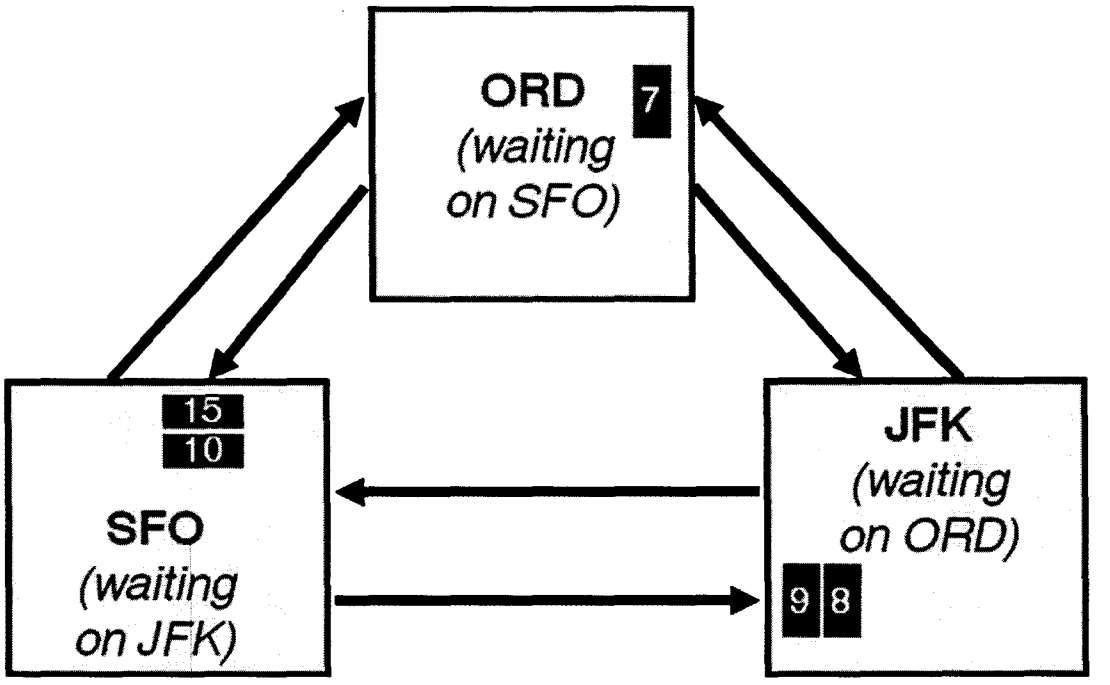
a) According to the Network Time Protocol Latency and Offset Estimation, explain how to find offset between clocks. (6 marks)

b) Suppose clock is 12 milliseconds ahead, interrupt generated every 10 milliseconds, explain how to phase in during re-synchronizing clocks. (4 marks)

Name_____ ID_____

Question 8 (10 marks; 20 minutes)

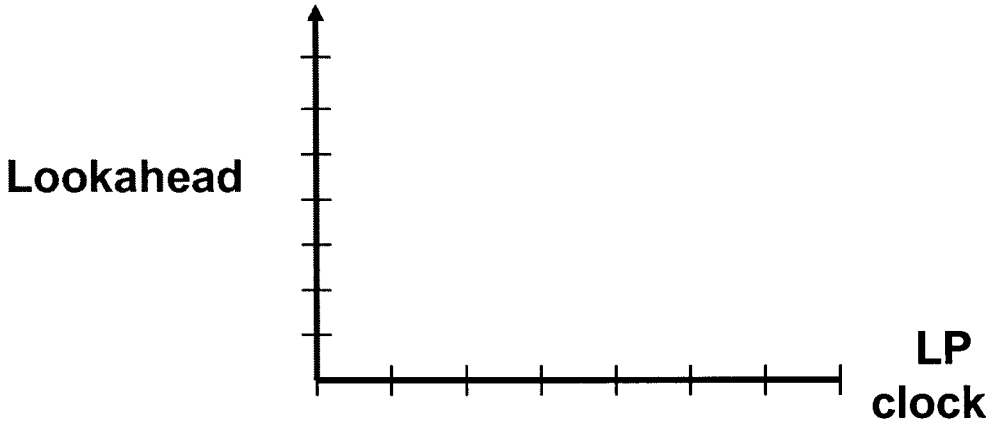
From the following airport topology, show how the Deadlock Avoidance Using Null Messages algorithm solves the problem. Assume minimum delay between airports is 4 units of time. Initially, JFK is at time 4.



Name_____ ID_____

Question 9 (10 marks; 10 minutes)

If a logical process is at simulation time 5 and *lookahead* is 3, use the below graph to help with answering the following questions.



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

b) If *lookahead* were to increase to 9, what should be done?

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c) If *lookahead* were to decrease to 2, what should be done?

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----End of Examination----

Pichaya Tandayya

Lecturer

Name_____ID_____