Operating Systems (COMP2006)

CURTIN UNIVERSITY
Computing Discipline
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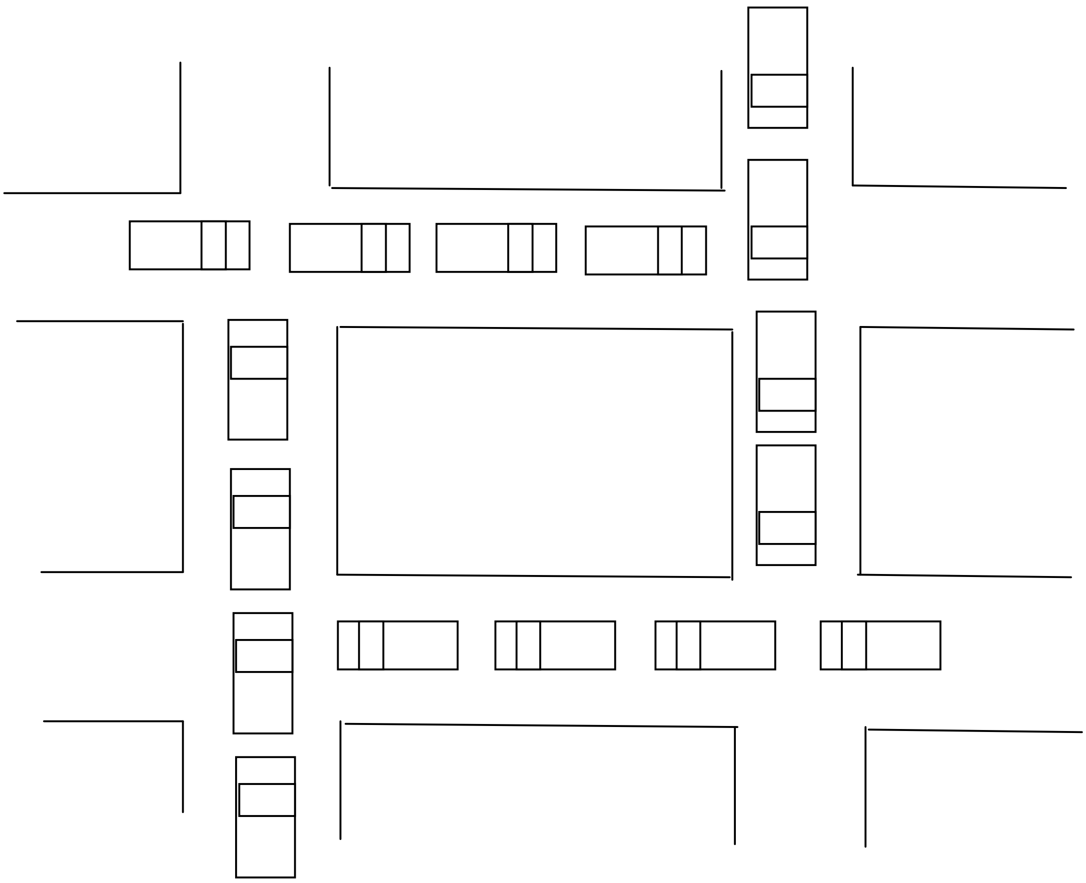
Worksheet 5

1. Consider the following traffic deadlock:



   a) Show that the four necessary conditions needed for deadlock hold in the traffic deadlock.

   b) Provide a simple rule for avoiding deadlock in the example.

2. List three overall strategies in handling deadlocks.

3. Can we break 'mutual exclusion' condition to prevent deadlock? Can we break 'hold

and wait' condition? Justify your answer.

4. In a real computer system, neither the resources available nor the demands of processes for resources are consistent over long periods (months). Resources break or are replaced, new processes come and go, new resources are bought and added to the system. If deadlock is controlled by the banker's algorithm, which of the following changes can be made safely (without introducing the possibility of deadlock), and under what circumstances?

   - Increase Available (new resources added).
   - Decrease Available (resource permanently removed from system).
   - Increase Max for one process (the process needs more resources than allowed, it may want more).
   - Decrease Max for one process (the process decides it does not need that many resources).
   - Increase the number of processes.
   - Decrease the number of processes.

5. Consider a system with seven processes, A through G, and six resources, R through W, each with one instance. Resource ownership is as follows.

   - Process A holds R and wants S
   - Process B holds nothing but wants T
   - Process C holds nothing but wants S
   - Process D holds U and wants S and T
   - Process E holds T and wants V
   - Process F holds W and wants S
   - Process G holds V and wants U

   (i) Draw resource-allocation graph for the system
   (ii) Draw the corresponding wait-for graph
   (iii) Is this system deadlocked?
   (iv) If so, which processes are involved?

6. Consider the following snapshot of a system that is using the banker's algorithm:

	Allocation	*Max*	*Available*
	A B C D	A B C D	A B C D
P_0	0 0 1 2	0 0 1 2	1 5 2 0
P_1	1 0 0 0	1 7 5 0	
P_2	1 3 5 4	2 3 5 6	
P_3	0 6 3 2	0 6 5 2	
P_4	0 0 1 4	0 6 5 6	

a. What is the content of matrix *Need*?
b. Is the system in a *safe state*?
c. If a request from process P_1 arrives for (0, 4, 2, 0), can the request be granted immediately?

7. Consider a system with the following resource types:

- tape drives (4 units)
- plotters (2 units)
- printers (3 units)
- CD ROMs (1 unit)

At time *t*, there are three processes with the following information for their resource allocations and additional resource requests:

- process 1: allocation - one printer, additional requests – two tape drives and one CD ROM

- process 2: allocation - two tape drives and a CD ROM, additional requests – one tape drive and one printer

- process 3: allocation - a plotter and two printers, additional request - two tape drives, one CD ROM, and one plotter

(i) Is the system deadlocked? (Show the process sequence if the system is not deadlocked, and show the processes involved if the system is deadlocked)

(ii) Is the system deadlocked if process 3's additional requests include only two tape drives and one plotter?