Planning Document

Course: Operating Systems **Course Faculty:** Dr Suresh Kumar K

Activity - Thinking Aloud Pair Problem Solving **Class: IV Sem IT**

Teaching Unit/Point: Unit 2 – Broad Topic – Deadlock Avoidance
Sub. Topic – Bankers Algorithm

Learning Objective: ***At the end of the lecture, students will understand how deadlock is avoided using the banker's algorithm.***

The choice of activity and its justification

Purpose of the Activity Thinking Aloud Pair Problem Solving

- To identify the students' understanding of deadlock avoidance using bankers' algorithms.
- Similarly, to identify the student proficiency in applying banker's algorithm in a real-time problem.
- Students should practice applying their knowledge to various problems, and this activity will enhance collaborative learning and critical thinking.
- This activity is scheduled on an immediate day after the banker's algorithm is taught to the students.

Case Study 1

Considering a system with five processes P_0 through P_4 and three resources of type A, B, C., Resource type A has ten instances, B has five instances, and type C has seven instances. Suppose at time t_0 following snapshot of the system has been taken:

Process	Allocation	Max	Available
	A B C	A B C	A B C
P_0	0 1 0	7 5 3	3 3 2
P_1	2 0 0	3 2 2	
P_2	3 0 2	9 0 2	
P_3	2 1 1	2 2 2	
P_4	0 0 2	4 3 3	

1. **Find the Need matrix.**

2. **Is the system in a safe state?**
3. **If Yes, then what is the safe sequence?**

Answer

1. Need Matrix

Process	Need		
	A	B	C
P_0	7	4	3
P_1	1	2	2
P_2	6	0	0
P_3	0	1	1
P_4	4	3	1

2. By applying the safety algorithm, the system is in a safe state.
3. The safe sequence is P1, P3, P4, P0, P2

Case Study 2

A single processor system has three resource types X, Y and Z, shared by three processes. There are five units of each resource type. Consider the following scenario, where the column allocation denotes the number of units of each resource type allocated to each process, and the column request denotes the number of units of each resource type requested by a process to complete execution.

	Allocation			**Request**		
	X	**Y**	**Z**	**X**	**Y**	**Z**
P0	**1**	**2**	**1**	**1**	**0**	**3**
P1	**2**	**0**	**1**	**0**	**1**	**2**
P2	**2**	**2**	**1**	**1**	**2**	**0**

1. **Find the Max Need of each processor of each resource type.**
2. **Which of these processes will finish LAST?**
    a. **P0**
    b. **P1**
    c. **P2**
    d. **None of the above since the system is in a deadlock**
3. **Is the system is in a safe state?**

Answer

1. **Max Need of each processor**

Max Need			
	X	**Y**	**Z**
P0	**2**	**2**	**4**
P1	**2**	**0**	**3**
P2	**3**	**4**	**1**

2. **There exists a safe sequence P1, P0, P2 in which all the processes can execute.**
3. **So, the system is in a safe state. Process P2 will execute at last.**

The procedure followed in conducting the activity

Team Formation

I have a class strength of 32, So I planned to divide the class into eight groups of 4 members in each group. Each group has two pairs, and each pair will have one case study question assigned as a random pick.

Step1: Each group are asked to work in pairs, in pair. One student act as the 'Solver." and the other as the "Inquirer". Each Solver has a copy of the problem, and each Inquirer has a copy of the solved problem.

Step 2: The problem Solver reads the problem aloud and works out the solution in steps. The Inquirer follows all Solver's procedures, catches any errors/flaws, and asks questions if the Solver's reasoning becomes unclear. The questions asked are not meant to guide the Solver but only to point out the error. The solvers among each group are allowed to brainstorm before they start solving the problem.

Step 3 After the first round, the pairs then work on the second round where the Solver become the Inquirer and vice versa.

Step 4 Each pair are picked randomly to brief how they obtained the solution.

Steps to implement the activity (Total duration Maximum of 1 hour)

Step 1: On the day of the activity, the activity begins by explaining the activity's objective and implementation plan. (5 Minutes)

Step 2: Group separation, identification of “Solver” and “Inquirer” in each group and case study distribution (10 Minutes)

Step 3: Problem-solving Round1 (15 Minutes)

Step 4: Problem-solving Round2 (15 Minutes)

Step 5: Solution discussion and Feedback collection (15 Minutes)