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| **https://upload.wikimedia.org/wikipedia/commons/thumb/4/4e/VU_Logo.png/260px-VU_Logo.png** | **Operating System (CS604)**  Assignment # 03 **Fall 2020** | **Total marks = 15**  **Deadline Date 05/02/2021** |
| **Please carefully read the following instructions before attempting the assignment.**  **RULES FOR MARKING**  **It should be clear that your assignment would not get any credit if:**   * **The assignment is submitted after the due date.** * **The submitted assignment does not open or the file is corrupt.** * **Strict action will be taken if the submitted solution is copied from any other student or the internet.**   **You should consult the recommended books to clarify your concepts as handouts are not sufficient.**  **You are supposed to submit your assignment in Doc or Docx format.**  Any other formats like scan images, PDF, Zip, Rar, Ppt, and Bmp, etc will not be accepted.  **OBJECTIVE**  **The objective of this assignment is to provide hands-on experience of:**   * **Safety Algorithm** * **Deadlock Avoidance.** * **To learn and understand Banker’s Algorithm.** | | |
| **NOTE**  **Assignement No. 3 covers 23-29 lectures. No assignment will be accepted *after the due date via email in any case* (whether it is the case of load shedding or internet malfunctioning etc.). Hence refrain from uploading assignments in the last hour of the deadline. It is recommended to upload the solution file at least two days before its closing date.**  **If you find any mistake or confusion in the assignment (Question statement), please consult with your instructor before the deadline. After the deadline, no queries will be entertained in this regard.**  **For any query, feel free to email at:**  **CS604@vu.edu.pk** | | |

**Question No. 1 15 Marks**

Let us suppose a system with 5 processes P0 to P4 and four resource types R0 to R3. R0 has 9 instances, R1 has 3 instances, R2 has 2 instances, R3 has 2 instances. Let us consider that at time T= 0, the system has the following state.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Processes | Allocation | | | | Max | | | | Available | | | |
| Resource Types | R0 | R1 | R2 | R3 | R0 | R1 | R2 | R3 | R0 | R1 | R2 | R3 |
| P0 | 3 | 1 | 1 | 0 | 5 | 2 | 1 | 0 | 2 | 1 | 0 | 0 |
| P1 | 2 | 0 | 0 | 0 | 2 | 1 | 0 | 1 |  |  |  |  |
| P2 | 0 | 0 | 1 | 1 | 0 | 1 | 2 | 1 |  |  |  |  |
| P3 | 2 | 1 | 0 | 0 | 3 | 2 | 1 | 1 |  |  |  |  |
| P4 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 2 |  |  |  |  |

1. Calculate the Need Matrix for each process (P0 to P4) from the information given in the table.
2. Use the safety algorithm to find out that either the system is in a safe state or not. Write down the complete available Matrix (work matrix).
3. If the system is in a safe state then write down the safe sequence and if the system is not in a safe state then give a reason to support your answer.