Exercise 4

Question 1

Consider the following query from a client:
9 5 1 0 5 6 5 4
(The user is trying to read page 9 from disk, then page 5, page 1, page 0…)
Assuming there are 3 buffers in the buffer pool. Please sketch the processes of how blocks are replaced in 3 different buffer replacement policies (Least Recently Used, First In First Out, Most Recently Used) respectively. Also count the number of page faults in each scenario.

Question 2

Construct a scenario leading to the worst-case of the MRU buffer replacement policy.

Question 3

Consider the following incomplete schedule *S*:

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T1: R(X) R(Y) W(X)           W(X)
T2:                R(Y)           R(Y)
T3:                     W(Y)
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Determine (by using a precedence graph) whether the schedule is serializable

Question 4

An IT company developed a new database system to record the static data of the coming Opera
House Open Day including the number of reservations X, remaining gifts Y and meals ordered Z.
Here is a schedule of three transactions:
S1, R1(X), S2, R2(Y), W1(X), E1, S3, R3(X), A, W2(Y), E2, R3(Y), B, W3(Y), W3(X), E3
Where Si indicates the start point of transaction i, Ei indicates the end point of transaction i, Ri(X)
indicates a read operation in transaction i on a variable X, and Wi(X) indicates a write operation in
transaction i on a variable Y.
Answer the following questions and justify your answers.
1) Assume that the system crashes at B, what should be done to recover the system?
2) Assume a checkpoint is made at point A, what should be done to the three transactions when the crash happens at B?