MIDWESTERN STATE UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

CMPS 4103- Introduction to Operating Systems

Fall semester 2022

Student name: Ethan Coyle

Assignment #3 – Memory Management - due date 10/27

Problem 1 A computer has four page frames. The time of loading, time of last access, and the R and M bits for each page are shown below (the times are in clock ticks)

Page	Loaded	Last ref.	R	M
9	230	280	1	1
1	126	275	1	0
7	270	282	0	1
3	140	266	1	0

a) Which page will NRU replace?

it will replace page 7

b) Which page will FIFO replace?

it will replace page 1

c) Which page will LRU replace?

it will replace page 6

d) Which page will second chance replace?

it will replace page 7

Problem 2 Consider a program with two segments: instructions in segment 0 and read/write data in segment 1. Segment 0 has read/execution protection and 1 has read/write protection. The system uses paged virtual memory, virtual addresses with a one-bit segment number, 3-bit page number and 8 bit offset. The page table is shown below (all values are decimal):

Segment 0		**Segment 1**	
Read/Execute		**Read/Write**	
Virtual Page #	**Page Frame #**	**Virtual Page #**	**Page Frame #**
0	2	0	On Disk
1	On Disk	1	14
2	1	2	9
3	5	3	6
4	On Disk	4	On Disk
5	On Disk	5	7
6	4	6	8
7	3	7	12

Identify the physical address (or page fault or access violation) in hexadecimal for the following cases.

(a) Fetch address $61A_{16}$

41A

(b) Store into address $36B_{16}$

this is a access violation

(c) Fetch from address $1F2_{16}$

results in a page fault

(d) Store into address 935_{16}

E35