Homework 6

Due on November 9 (Tuesday), 2021

Problem 1.

The following sequence of 15 virtual page numbers is requested during a virtual-physical memory allocation:

3, 4, 2, 6, 4, 7, 1, 3, 2, 6, 3, 5, 1, 2, 3

LRU (Least Recent Used) page replacement is used in the system. The physical memory page capacity has 8 options: 1 page, 2 pages, 3 pages, 4 pages, 5 pages, 6 pages, 7 pages, and 8 pages.

Calculate the page hit ratio for each option, which is the fraction of page references in the physical memory in the 15 references. We assume that the main memory is initially empty.

The answer for 1 page of physical memory is 100% miss rate or 0% hit rate.

Problem 2.

Considering the following nested sequential loop:

```
For i = 1 to 10
   For j = 1 to 10
       x(j) = x(j) + 1;
```

All the operations are performed in the cache by LRU replacement, and the cache size is 9 elements.

Question 1.
What is the total number of read accesses in the cache for this program?

Question 2.
What is the cache hit rate (for read only)?

Problem 3.

Consider a virtual address space for 32 pages of 2-KBytes each, which is mapped to a 1-MByte physical memory space.

Question 1.
What is the format of the virtual address (virtual page address + page offset)?

Question 2.
What is the format of the physical address (physical page address + page offset)?

Question 3.
What is the height (number of entries) and width (in bits) of the page table (disregarding the Valid bit and the Access Right bits)?

Questions 4.
If the physical memory space is reduced by half, what changes do we need to make for the page table?