# CS401: ADVANCED OPERATING SYSTEMS

Assignment – 02

**Due Date: 10 November 2026**

## INSTRUCTIONS

- Click the link in Q1 and enter your Roll Number **in uppercase letters**, e.g. 26MCMT01 or 26MCMI01 to get an address reference string $\omega$. **Do this during regular hours on weekdays**.
- Copy it somewhere safe. You should get the same reference string as long as you enter your roll number.
- Use the reference string to answer the Q1. You MUST USE the reference string that you get. I have a copy of all the reference strings; so do not use someone else's.
- Submit Q1 in a PDF document. Submit the code in Q2 as `.c` and `.h` files. The outputs and any explanations may be in another PDF document.
- Create a `.zip` file with the two files and email them to me with a subject line having the words, **Assignment 2** on or before the due date at
  `chakravarthybhagvati@uohyd.ac.in`

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1. A virtual memory sytem uses pages numbered from 1 to 5. Given the following address reference string (given as page numbers),

   Click here for address reference string

   (a) **(6 Marks)** Construct the stack $S(\omega)$ and a priority list $L$ using the `MRU` page replacement algorithm. Are they identical?

   (b) **(4 Marks)** Compute the cost functions $C(3, \omega)$ and $C(2, \omega)$

   (c) **(2 Marks)** Using $C(3, \omega)$, calculate number of page faults for $m = 4$.

2. **(6 Marks)** Write a function to generate an address reference string $\omega$ as shown below:

   ```
   int generate_omega(int psize, int mtype, int numreg)
   ```

   **`psize`:** size of the address string ($> 20000$)

   **`msize`:** type of the program:

   - `GOOD` 98% stable regions, 2% transitions
   - `BAD` 94% stable regions, 6% transitions

- `UGLY` 90% stable regions, 10% transitions

**`numreg`:** number of regions; if `numreg = 3`, it means that there are three stable and three transition regions. *The first region in the address string MUST be a transition region.* This is the region where the required pages are being brought into memory. Stable region is when a *locality of reference* is established and the page numbers in the string are relatively stable.

You will also need to use the following.

**`WS_SIZE`:** This the rough size of the Working Sets in the stable regions. The WS size varies around this value in sable regions. In transition regions, the WS size will be much larger.

**`NUMPAGES`:** The *total* number of pages for the process. A subset of these pages will form a Working Set. If `NUMPGS = 32`, then the page numbers in the address reference string will have values {1, 2, ..., 31, 32}.

**`DELTA`:** The interval used in computing the Working Set; same as that explained for $W(t, \Delta)$ in class.

Plot address number on the X-axis vs address value on the Y-axis. For example, if $|\omega| = 20000$, X-axis will range from 1 to 20000, and Y-axis will range from 1 to `NUMPAGES`.

3. **(2 Marks)** Write a function to calculate Working Set, $W(t, \Delta)$ from the address reference string $\omega$ from Q2. $t$ varies from 1 to `psize`.

$$W(t, \Delta) = 0 \quad \text{if } t \leq \Delta$$

Plot $W(t, \Delta)$ against $t$.

Marks for Q2 and Q3 will be awarded based on how realistic your generated $\omega$ and $W(t, \Delta)$ are as compared against the plot on Page 149 (Figure 5.9) in the book, "*Operating Systems: Advanced Concepts*". This is provided in the "Materials" section of our course webpage.