University of Windsor

School of Computer Science

60-330 Operating Systems Fundamentals - Winter 2018
Assignment 4

Deadline: **Thursday February 22 2016 at 11:59pm**

Rules: This assignment must be done individually, submitted individually, and will be evaluated individually. You are may discuss about the problems, concepts and/or ideas with other students. However, the source code for your programs should not be identical or significantly overlap with others'.

Objectives: The aim of this assignment is to help students understand the main concepts of memory management and allocation. Students will obtain hands on experience in working with C routines for fast memory allocation.

Tasks:

1. Assume that a system has a 32-bit virtual address with a 4-KB page size. Write a C program that is passed a virtual address (in decimal) on the command line and have it output the page number and offset for the given address. As an example, your program would run as follows:

   ```
   ./a.out 19986
   ```

   and the program would output:

   ```
   The address 19986 contains:
   Page number = 4
   Offset = 3602
   ```

   Writing this program will require using the appropriate data type to store 32 bits. We encourage you to use unsigned data types as well. All calculations should be performed as fast as possible (i.e., nearly in real time). For this purpose, the use of left/right shift and/or mask operators in C (or equivalent) is required.

   Run your program with 5 different virtual addresses and show the results in your report.

2. Change your program to generate *n* random virtual addresses between 0 and 2^{32}-1 and compute the page number and offset for each address – do not output anything on the console. Run your program with *n* = 1,000,000 random addresses and compute the total CPU time. In your report, show how you run it and comment on your results.

Submission:

1. You must submit: (i) a short report (in PDF or word), which contains the details of the implementation, the runs (screenshots/inputs/outputs), and the corresponding comments, and (ii) the source code of your program. You should upload all these files to the Blackboard, as a **single** zip file.
2. In your report, you must provide details about the implementation, show how you run the programs and the comments, accordingly. Marks will be deducted for missing explanations/information.

3. Add the following note at the beginning of your report: "*I confirm that I will keep the content of this assignment confidential. I confirm that I have not received any unauthorized assistance in preparing for or writing this assignment. I acknowledge that a mark of 0 may be assigned for copied work.*" + Name + SID
4. Any submission after **the due date** will receive a penalty of 10% for the first 24 hrs, and so on, for up to seven days. After seven days, the mark will be *zero*.
5. Unlimited resubmissions are allowed. But keep in mind that we will consider/mark the last submission. This means that if you resubmit after the deadline, a penalty will be applied, even if you submitted an earlier version before the deadline.