Project OS5

Due Date: December 10

This is an **individual** project.

Purpose

You will simulate a working set memory management policy and generate some wonderful statistics. In addition, you will use the statistics to produce some graphs and to answer a question that will count toward your final exam grade.

Problem

A certain program references various pages in memory; each page is identified with 1 digit. When the program is run, the following reference string, ω, is generated:

$$\omega = 272722(28272272927222)^n 272722(272733733(373338393373737333)^{n-i+1} 3637322)^n$$

Assume $n = 10$. Based on the reference string for n, write a program that will analyze the run-time behavior when a working set memory management policy is used.

Input

Input should be the maximum Δ (see below). You'll want to use small values of Δ when you first start to make debugging easier.

Output

Your program should generate several values:

$$\begin{aligned} \Delta &= \text{window size} \\ P(\Delta) &= \text{total number of page faults} \\ W(\Delta) &= \text{average working set size} \\ F(\Delta) = \tfrac{P(\Delta)}{|\omega|} &= \text{average page fault rate} \end{aligned}$$

Find these values for Δ ranging from 1 to 200. For debugging purposes, here are the first 5 values of Δ:

Δ	$P(\Delta)$	$W(\Delta)$	$F(\Delta)$
1	879	1.000	0.675
2	333	1.674	0.256
3	313	1.929	0.240
4	292	2.168	0.224
5	237	2.390	0.182

- Plot the following curves, using Excel or other nice graphing program: Δ vs. $P(\Delta)$, Δ vs. $W(\Delta)$, and Δ vs. $1/F(\Delta)$, for Δ ranging from 1 to 200. Be sure to adequately label the graph.
- Final exam question: From the plot of Δ vs. $1/F(\Delta)$, explain the cause of all "knees" in the graph in terms of reference string structure. Remember the Honor Code is in effect.

Notes

- The first step in getting the statistics is to generate the entire string. The notation $(2722)^n$ means repeat 2722 n times. As you can see, the string above will be quite long and annoying. To help you out, I've written a function that generates the entire string. You can find it on the course web page.
- Given the reference string, you will have to compute the various statistics. To do this, create a character array of size Δ and "move" the window along the reference string by one page. One of the following actions will occur:

  1. the page is added to the set, and none is removed
  2. the page is added to the set and one old page is removed
  3. the page is already in the set
  4. the page is already in the set and one old page is removed

  Whenever a page is added to the set, a page fault occurs.
- Your source code is due by midnight on December 10^{th}. Hand in the hard copy and your graphs in class on December 11^{th}.
- The answer to the exam question is due at the time of the final exam on Tuesday, December 15^{th}.
- You will have a written homework assignment to do during this project's time span, so plan accordingly.

! Something's wrong–
– another LaTeX error message