

Exercises for lab 3 of CS2101a

Instructor: Marc Moreno Maza, TA: Alexandre Temperville

September 24, 2012

1 Exercise 1

Modify the C program below such that it computes and prints the average value in the array `a`.

```
#include <stdio.h>
#include <stdlib.h>

int main() {
    int n, i;
    printf ("\n n = ");
    scanf ("%d", &n);
    int a[n];
    for (i=0; i < n; i++) a[i]=rand()%n;
    printf ("\n");
    for (i=0; i < n; i++) printf ("%d ", a[i]);
    printf ("\n");
    return 0;
}
```

2 Exercise 2

Read the web page

http://en.wikipedia.org/wiki/Insertion_sort

Write a C program that successively

- reads a positive integer value n from the user,
- generate an array `a` with random entries of type `int` with values in the range $0 \dots n - 1$.
- sort them (in place) using the insertion algorithm.

Using the UNIX `time` command, measure the running time of this program when $n = 2 \times 10^k$ for $k = 0, 1, 2, 3, 4, 5, 6$.

3 Exercise 3

Consider the following C program

```
#include <stdio.h>
#include <stdlib.h>

int main() {
    int n, p, i, j, k;
    float c;
    printf ("\n n = ");
    scanf ("%d", &n);
    int a[n];
    while (1) {
        printf ("\n p = ");
        scanf ("%d", &p);
        if (p <= n) break;
    }
    for (i=0; i < n; i++) a[i]=rand()%p;
    printf ("\n");
    c = 0;
    for (i=0, j=a[0]; i < n; i++) {
        c = (c * i + j) / (i+1);
        for (k=0; k<100; k++) j = a[j];
    }
    printf ("\n c = %f \n", c);
    return 0;
}
```

- For $n = 2 \times 10^6$, compare the running times when p takes successively the values 2×10^k for $k = 0, 1, 2, 3, 4, 5, 6$.
- What do you observe? Explain?