CS33 Homework Assignment 2 Solutions

Fall 2023

1. Consider the following 2D array in C:

```
int A[P][Q];
```

   a. We'd like to work with column 1 of the array, i.e., the data in A[0][1], A[1][1], A[2][1], etc. In particular, we want an *int* * that refers to a 1D array containing this column. Can this be done by setting such a pointer to point to the column's first element, or must we copy the elements of the column into a separate 1D array?

      Answer: you must copy the elements of the column into a separate 1D array.

   b. We'd now like to work with row 1 of the array, i.e., the data in A[1][0], A[1][1], A[1][2], etc. In particular, we want an *int* * that refers to a 1D array containing this row. Can this be done by setting such a pointer to point to the row's first element, or must we copy the elements of the row into a separate 1D array?

      Answer: setting a pointer is sufficient.

2. We want a (3D) array of the 2D arrays of problem 1, i.e., we'd like to organize P MxN arrays as a single PxMxN array.
   a. How does one declare an array of P of the 2D arrays of problem 1?

      Answer: `int A[P][M][N];`

   b. We would like a pointer *ptr* that refers to a 2D array (of problem 1), so that we can use it to iterate through the array of such 2D arrays. How would one declare such a pointer? (It's definitely not cheating to test your answer using gcc!)

      Answer: `int ((*ptr)[M][N]);`
      also correct: `int (*ptr)[M][N];`

   c. We would like a function *func* that takes an *int* as an argument and returns a pointer to our 2D array. How would one declare such a function?

      Answer: `int ((*func(int))[M][N]);`
      also correct: `int (*func(int))[M][N];`

3. What's wrong, if anything, with each of the following?
   a.

```
int proc(int m) {
```

```
        static int array[m];
        // ...
}
```

Answer: the bounds for *array* must be known before the program is run, since the array must be allocated when the program is run. As written, *array*'s size could be different on each invocation of *proc*, which makes no sense, since *array* is allocated when the program starts.

b.

```
struct array_struct {
        int array[20];
};

struct array_struct init(void) {
        struct array_struct a_s;
        for (int i=0; i<20; i++)
                a_s.array[i] = i;
        return a_s;
}

int main(void) {
        struct array_struct x = init();
        // ...
}
```

Answer: there is nothing wrong with this code!

c.

```
int main(int argc, char *argv[]) {
        int a=0, b=0;
        int c;

        if (argc != 3) {
                fprintf(stderr, "Wrong number of args\n");
                exit(1);
        }
        a = atoi(argv[1]);
        b = atoi(argv[2]);
        switch(a) {
        case 0:
                c=b;
                break;
        case 1:
                a=b;
                break;
        default:
                c=a;
```

```
        }
        return a+b+c;
}
```

Answer: if *a* is inputted as 1, then *c* will be undefined and the result returned will be indeterminate.

d.

```
int *array;

void init(void) {
        int A[20];
        array = A;
}

int main(void) {
        init();
        array[7] = 6;
        // ...
}
```

Answer: the array *A* that is assigned to *array* in *init* goes out of scope once *init* returns. However, it is subsequently referred to within *main*.