

# Assignment 3

COMP SCI 2ME3 and SFWR ENG 2AA4

March 7, 2018

**Assigned:** March 6, 2018

**Part 1 (Spec):** March 12, 2018

**Receive Full Spec:** March 18, 2018

**Part 2 (Implement and Test):** March 26, 2018

**Last Revised:** March 7, 2018

All submissions are made through git, using your own repo located at:

`https://gitlab.cas.mcmaster.ca/se2aa4\_cs2me3\_assignments\_2018/\[macid\].git`

where [macid] should be replaced with your actual macid. The time for all deadlines is 11:59 pm.

## 1 Introduction

The purpose of this software design exercise is to design and implement a portion of the specification for a Geographic Information System (GIS). For Part 1, you are given a partial specification and asked to fill in the specification of the missing semantics. Once the specification is complete, you will implement it for Part 2. To have a common interface across the class, to facilitate unit testing by the TAs, you will implement the instructor provided specification, rather than your own.

A sample GIS raster map is shown in Figure 1.

You will complete the specifications for the modules described in the specification file. Your specifications should not involve writing algorithms or pseudo-code. The specifications should use discrete mathematics to specify the desired properties. That is, you

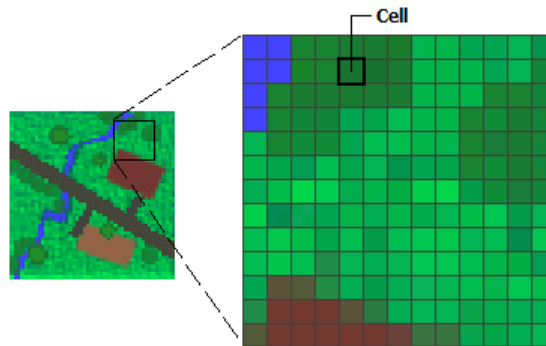


Figure 1: Example raster map

should be writing a *descriptive* specification as opposed to an *operational* specification. Specifications within a module are free to use access programs defined within the current module or from another module that is used by the current module. You should use the provided local functions. You shouldn't have to add more local functions, but you can, if you find them helpful.

All of your code should be written in C++. All code files should be documented using doxygen. Your report (for Part 1) should be written using LaTeX. Your code should follow the given specification exactly. In particular, you should not add public methods or procedures that are not specified and you should not change the number or order of parameters for methods or procedures. If you need private methods or procedures, you can add them by explicitly declaring them as private.

## Part 1

### Step 1

Complete the specification by addressing the comments given in the specification file `spec.tex`. To help you interpret the specification, some examples are shown in the Appendix to this assignment.

### Step 2

Write a critique of the interface for the modules in this project. Is there anything missing? Is there anything you would consider changing? Why? Your critique should appear as the

last section of `spec.tex`.

## Step 3

Push your spec, which will include the critique, in (`spec.tex` and `spec.pdf`) to your GitLab project repo. The report, including the specifications, should be written in LaTeX. This step should be completed by the deadline for Part 1 of the assignment.

## Part 2

### Step 4

After the report has been submitted, you will be provided with a complete specification for all of the modules. Implement the modules in C++. The names of the header files (in the `include` folder) are as follows: `DEM.h`, `LanduseMap.h`, `LineT.h`, `MapTypes.h`, `PathT.h`, `PointT.h` and `Seq2D.h`. You will be provided with a correct version of the Exceptions header file in `Exceptions.h`. The source files you should create are as follows: `LineT.cpp`, `PathT.cpp`, `PointT.cpp` and `Seq2D.cpp`.

### Step 5

Experiment with the implementation. Test the supplied `Makefile` rule for `experiment`. The purpose of this rule is to provide a means for “playing” with the code as you develop it.

### Step 6

Test the supplied `Makefile` rule for `doc`. This rule should compile your documentation into an html and  $\text{\LaTeX}$  version. Along with the supplied `Makefile`, a doxygen configuration file is also given in your initial repo. You should not change these files.

### Step 7

In the `test` folder you should have a corresponding test file for each module: `testLineT.cpp`, `testPathT.cpp`, `testPointT.cpp` and `testSeq2D.cpp`. For `testSeq2D.cpp` you only need to test one of `DEM` or `LanduseMap`. The testing framework being used is called

catch, as discussed in the tutorials. The header file you need, along with the `testmain.cpp` file, will already be pushed to your repo. Each procedure should have at least one test case. For this assignment you are not required to submit a lab report, but you should still carefully think about your rationale for test case selection. Please make an effort to test normal cases, boundary cases, and exception cases.

The supplied makefile (named **Makefile**) will have a rule named `test`. This rule should run all of your test cases.

## Step 8

Push all of your code files to your GitLab project repo. This step should be completed by the deadline for Part 2 of the assignment.

### Notes

1. Please put your name and macid at the top of each of your source files
2. Your program must work in the ITB labs on mills when compiled with its versions of g++ (Version 7), LaTeX, doxygen and make.
3. So that you will have the correct version of g++, please add the following:  

```
. /opt/rh/devtoolset-7/enable
```

to the bottom of your `.bashrc` file on mills. (An earlier version of g++ has to concurrently exist on mills; this allows you to switch to the version we are using.)
4. Many choices are available for containers to store your 2D sequence. So that unit testing will work between submissions, we need to make a standard decision. Therefore, please use a vector for your C++ implementation for the constructor for Seq2D:  

```
template <class T>
Seq2D<T>::Seq2D(vector<vector<T>> s, double scale)
{
    // details
}
```
5. Pointers should *not* be used in your interfaces. All methods should use pass by value and all methods should return a value.
6. Implement templates following the approach used in the tutorial. That is, the `int` and `LanduseT` instances should be explicitly created in the `Seq2D.cpp` file. The header files `DEM.h` and `LanduseMap.h` will only need to be the appropriate typedefs.

7. Your grade will be based to a significant extent on the ability of your code to compile and its correctness. If your code does not compile, then your grade will be significantly reduced.
8. Any changes to the assignment specification will be announced in class. It is your responsibility to be aware of these changes. Please monitor all pushes to the course git repo.

## 2 Appendix

