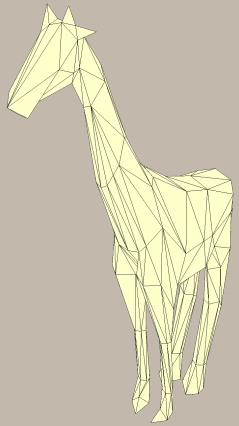


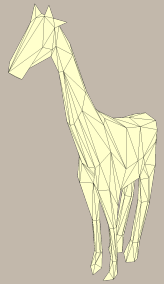
Lecture 01 - Anatomy of a C++ program

Philip Caplan

CSCI 0422 - Geometric Modeling (Spring 2022)

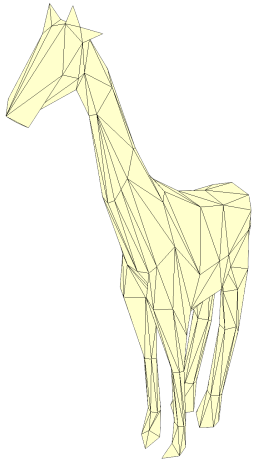
Middlebury

Introduction



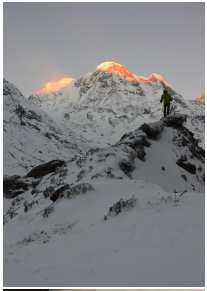
By the end of this lecture . . .

- You will know what geometric modeling is, and how we will study it in the course.
- You will be familiar with the course structure and policies.
- We will write a small `C++` program that covers functions, headers, and pointers.
- You will know what you need to do before next class.



A little about me. . .

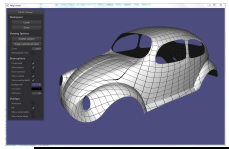
- Please call me Philip.
- I'm from Montreal, studied at McGill & MIT.
- I like to hike, practice yoga, and play drums.
- I have type I diabetes (managing my blood sugar while teaching can be challenging so I might need to eat some candy in class).

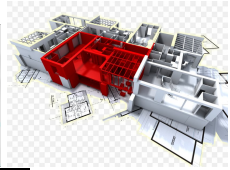


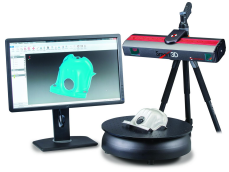
What is geometric modeling?

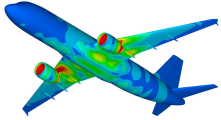
Geometric modeling is all about creating and manipulating digital representations (**meshes**) of 3d shapes.

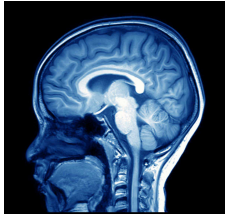
Why is this useful?

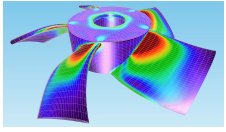


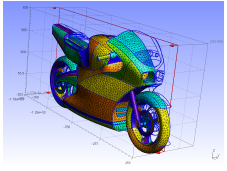




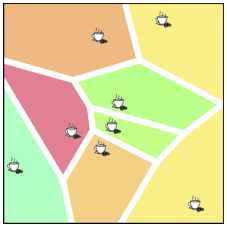


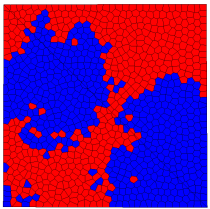


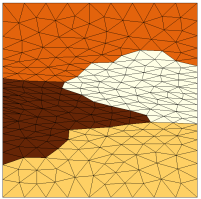


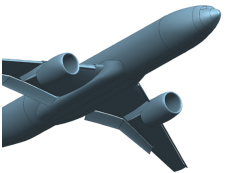


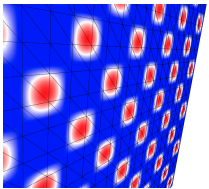
My research is all about meshes!

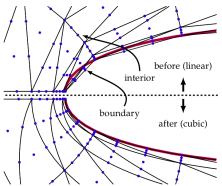


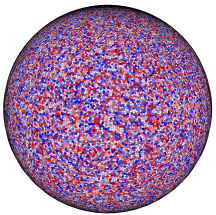


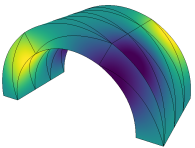






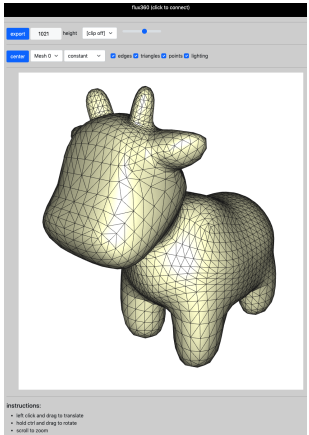






Main questions we want to ask.

- **How do we represent meshes?**
  mesh connectivity, half edges
- **How do we create meshes?**
  grids, Delaunay triangulations, Voronoi diagrams, reconstruction, constructive solid geometry
- **How do we modify meshes?**
  smoothing, subdivision, simplification, remeshing
- **What can we do with meshes?**
  parametrization, deformation, simulations



and how can we write efficient C++ code to do all of this?

All course materials will be shared via `flux`

framework for learning about unstructured meshing

- common code base you will use throughout the semester (exercises, projects),
- visualization done in your browser via **flux360** button on course website,
- you will get experience with software development practices, including version control, writing tests, continuous integration,
- you will work in pairs of two throughout the semester:
  - same partner for all exercises and projects,
  - groups will be set at the end of the second week
  - exercises in the first two weeks will allow you to see who you might want to work with.

coursework:

- **Daily exercises:** I will talk a little bit, you will write code, we will write the solution together.
- **Biweekly projects** (roughly): `C++`, approximation, Delaunay, subdivision & simplification.
- **Final project:** open-ended - we will cover several topics that will make for good final projects.

How should we communicate with you and each other?

- Personal matter? **email** or **private message in Slack**
- Otherwise? **channel in Slack**

join our slack workspace!

https://join.slack.com/t/csci422-s22/shared_invite/zt-12us80i4n-Xo6UxKaZ9bfjQ7VPKsSI9Q

Please use the channels as much as possible:

- Please don't send me a private message about course material or bugs.
- **announcements:** where I will post information about due dates, updates to `flux`, etc.
- **features:** is there something you want me to implement in `flux`? do I have a bug?
- **howto:** for questions about how to use certain components in `flux`, e.g. "How do I ... ?"
- **projects:** for project-specific questions, e.g. understanding parts of an algorithm.
- **updates:** automatically posts messages about pushes and pipelines for `flux-base`.

Please think of our class as a software development team.

- We work together, but we have different responsibilities.
- **Your job**: commit to the learning experience; put in your best effort to complete your assignments.
- **My job**: give you the infrastructure to complete your job, but I will not do your job for you.
- I can help you with conceptual and clarification questions, but **I cannot help you find bugs**.

When you're stuck on a problem: **pause, brainstorm, abstract, sketch, debug**.

Your introduction to the team: Project0 is a `LeetCode` problem (due 02/22).

Projects sneakpeek

Success Details ›

Runtime: 48 ms, faster than 5.61% of C++ online submissions for Reverse Nodes in k-Group.

Memory Usage: 11.8 MB, less than 8.36% of C++ online submissions for Reverse Nodes in k-Group.

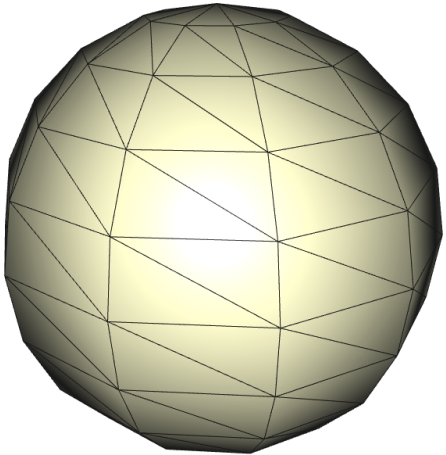
Next challenges:

Swap Nodes in Pairs | Swapping Nodes in a Linked List | Reverse Nodes in Even Length Groups

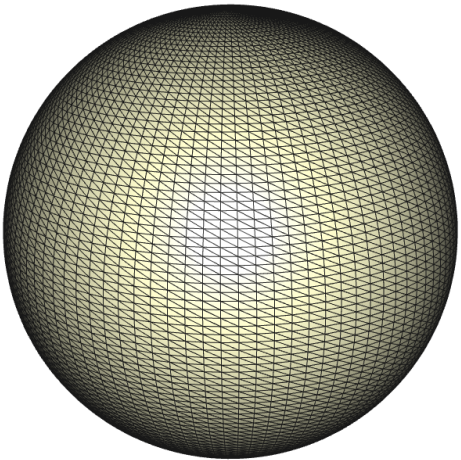
Show off your acceptance:

Time Submitted	Status	Runtime	Memory	Language
02/11/2022 09:41	Accepted	48 ms	11.8 MB	cpp
01/15/2022 11:18	Accepted	37 ms	11.7 MB	cpp

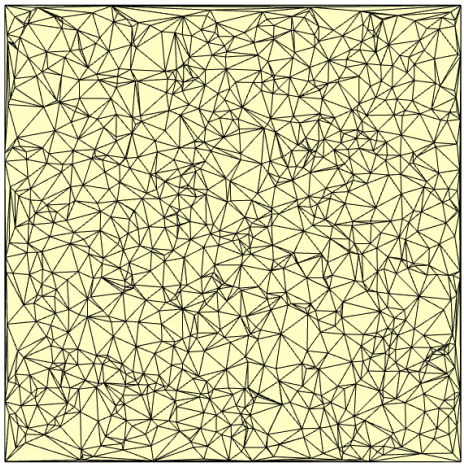
Projects sneakpeek



Projects sneakpeek



Projects sneakpeek



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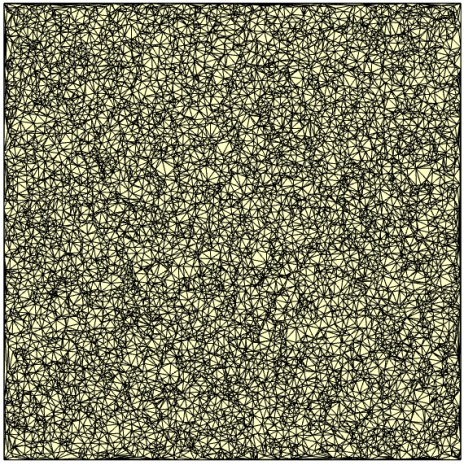

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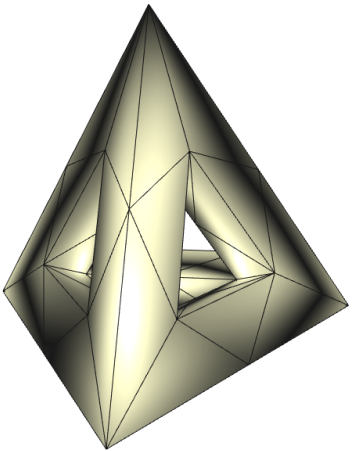

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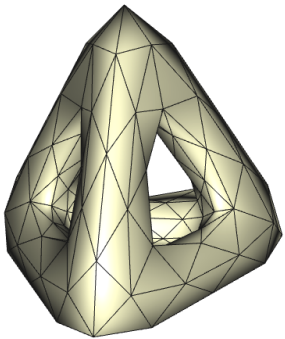

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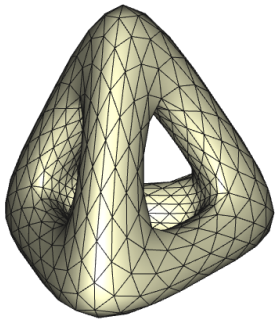

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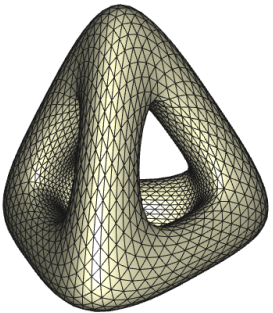

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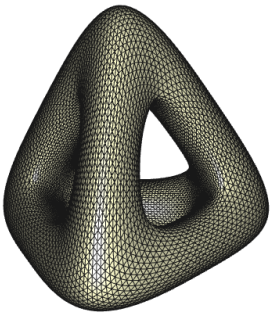

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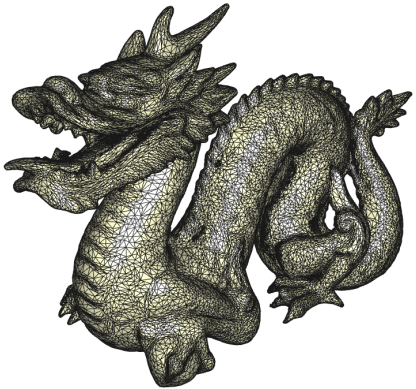

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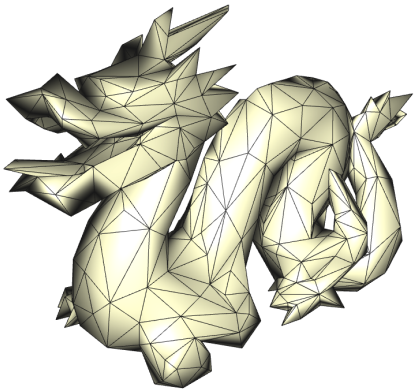

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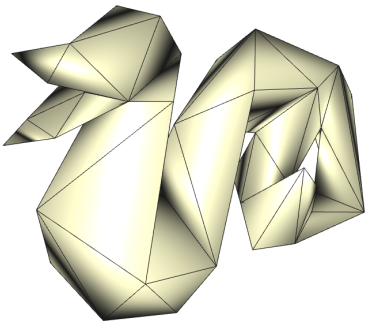

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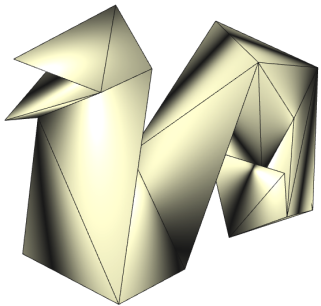

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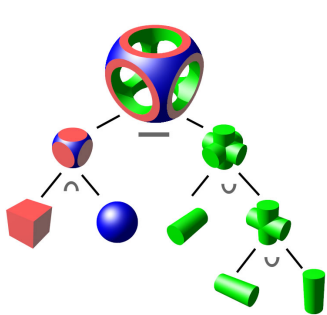

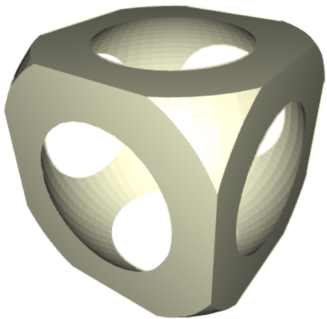

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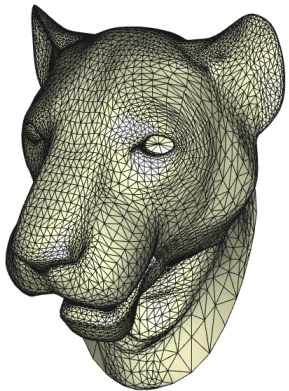

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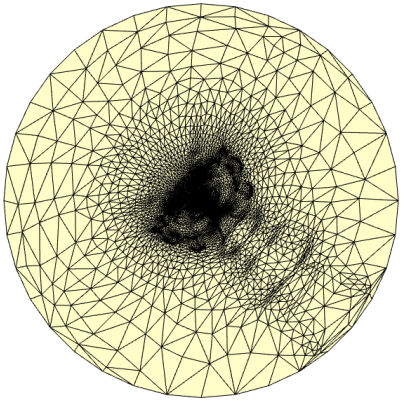

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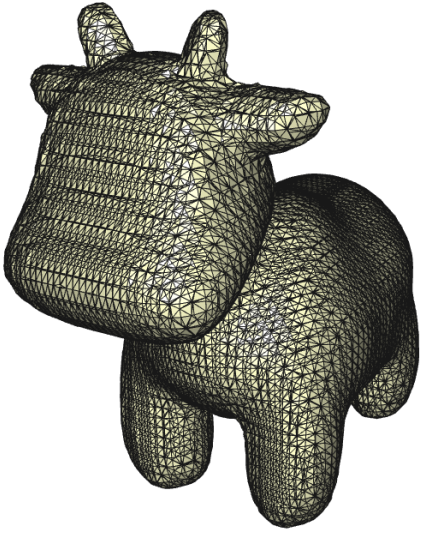

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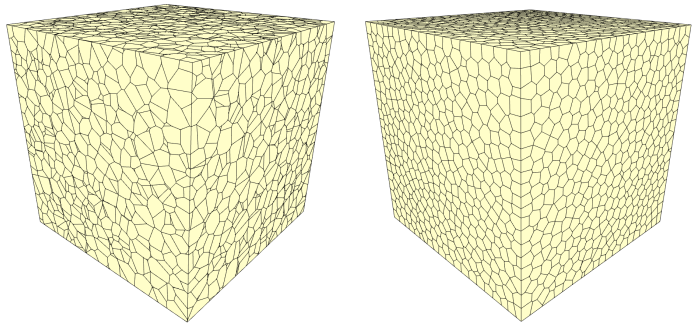
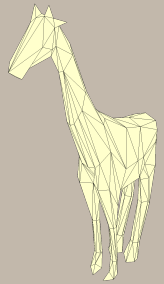


Anatomy of a C++ program



Building a C++ program with a Makefile

- Follow along at: https://replit.com/@pcaplan/csci422-exercise01-template and click **Fork repl**.
- Click on **Shell**, then type `make` to build and `./program` to run (or `make run`).

```
1  int
2  main() {
3
4    int x = 2;
5    float y = 3.14;
6    double z = 3.14;
7
8    return 0;
9  }
```

```
1  default:
2    g++ main.cpp -o program
3
4  run:
5    ./program
6
7  full:
8    g++ -c numerics.cpp -o numerics.o
9    g++ main.cpp -o program numerics.o
10
11 clean:
12   rm -rf program
```

Before next class

- familiarize yourself with **course web page**: `go/cs422` (https://csci422-s22.gitlab.io/home/calendar.html),
- **review notes** from today: https://gitlab.com/csci422-s22/flux-base/-/tree/main/notes/class01,
- follow instructions (at the end of notes from today) to **install development tools**,
- complete **background form**: https://forms.gle/mmjyQ3JkLwjycyCw9.