CS 185C Project Overview
For the project in CS 185C: Introduction to Ocean Modeling, you will create an ocean model configuration in MITgcm. Your model configuration should be used to investigate a specific science question – and your analysis and visualization of your model should answer this question. The model code and notebooks for analysis will be turned in on your Github repository for the class.

Project Due Date
Model Components: The final model components are due during the final exam slot for this class on **Wednesday, May 14 at 12:15.**

Project Components
The following table summarizes the key components of the project:

Component	Criteria for Full Points	Points (100 Total)
Github Documentation	The project directory of the CS 185C Github repository has a detailed README with an overview of the project and steps to repeat the experiment.	10
Science Question and Experimental Design	The model configuration and parameters are designed to answer a specific science question.	10
Initialization Notebooks	Notebooks are organized to generate the model initialization fields such as bathymetry and model geometry, as well as initial, external, and boundary conditions, as appropriate.	10
Model Configuration Files	All model code and namelist files required to replicate the experiment are provided on Github in organized directories.	10
HPC Implementation	The model configuration is run on the Spartan High Performance Computing Cluster using multiple CPUs.	15
Reproducibility	The model should be able to be run and the analysis replicated by someone familiar with Python and MITgcm.	10
Analysis Notebooks	One or more notebooks are generated to analyze the output of the ocean model experiments. The analysis should compare and contrast model output and answer the science question.	20
Visualization	A model visualization (movie) is generated to showcase the results of the experiment.	15

Spatial Guidelines
To run your simulation, you can use up to 28 CPUs on the Spartan computing cluster for your simulation. Each CPU will be responsible for a tile with 30-90 rows/cols. For example, consider a model grid with 360 rows and 240 columns. This model grid could be decomposed into tiles of size 60 x 60 with 6 tiles in the vertical direction and 4 in the horizontal direction, for a total of 24 tiles (to be distributed to 24 CPUs on 1 node). When designing the grid for your model, be sure to consider how you will distribute your model domain on CPUs and ensure you will have enough resources for your model.

Initialization Files
The initialization files for the model will be constructed during weeks 9-12 of the course. These will include the initial conditions (week 10), the external forcing conditions (week 11), and the boundary conditions (week 12). Once all of these files have been constructed, we will move our models to Spartan cluster and begin to run our simulations.

Some Project Ideas
The questions below represent some questions that could be investigated with an MITgcm configuration. However, you are also encouraged to investigate your own question.

1. What is the mean location of the loop current in the Gulf of Mexico?
2. How do seasonal monsoons in southeast Asia impact ocean stratification?
3. How would ocean currents change if Earth was spinning in the opposite direction?
4. How much faster would the Gulf Stream flow if the Earth rotated twice as fast?
5. How many circulations cells are present on Jupiter or Saturn?
6. What is the difference between the ggl90 and the gmredi schemes?
7. What effect does resolution have on horizontal heat transport?
8. An old myth says that toilets spin the opposite direction in the southern hemisphere when they are flushed. How big would your toilet need to be to experience the Earth's rotation?
9. What effect does the Amazon river have on ocean properties in coastal Brazil?

Note: You can develop your own model from scratch or you can modify and adapt and existing tutorial experiment to run your model.