Project selection guidelines:

Objective: *parallelize, analyze, and improve performance of a research-level problem (as opposed to "toy" or textbook problem) from a scientific, engineering, simulation, or big-data domains.*
Projects are to be done individually.

- **"Parallelize" means: either** to introduce parallelism from scratch (e.g., devise a new parallel algorithm) **or** change (augment) existing parallelism.
  - **Requirement:** to exhibit at least ***two different*** kinds of parallelism in your project, i.e., have a at least *two-way "hybrid"* parallelism in your project.
    - For example, have OpenMP and CUDA/OpenACC mixed or Message-Passing Interface (MPI) and OpenMP mixed or MapReduce mixed with OpenMP/OpenACC or Matlab with CUDA or MPI with CUDA in the ***same application.***
- **"Analysis" means:** to investigate ***strong*** and ***weak scalings,*** compute the parallel overhead, etc.
  - Note, for scaling results, you must use a platform bigger than your one laptop or desktop.
- **"Improve performance" means:** to tune application parameters of your project application based on your analysis to get an optimal performance.
- **Extra-credit:**
  - improve performance under energy-efficiency constraint.
  - create an HPC/BD application with data-collection in the loop (e.g., to optimize for for data velocity)

Project proposals guidelines:

- **Pre-proposal – Due October 9:**
  - *Typesetting:* 1 page maximum, US Letter format, minimum 11 point font, single-space.

  1. Title of your project.
  2. Describe your problem.
  3. Mention the computing platform(s) that you plan to use.
  4. What type of hybrid parallelism do you plan to use?
  5. What challenges to you anticipate?

  Note: Once the proposal idea is approved based on your pre-proposal, you may start working on the project while finishing up your final version for the proposal.

- **Proposal – Due November 4:**
  - *Typesetting:* 3 pages maximum, US Letter format, minimum 11 point font, single-space.

  1. Title of your project.
  2. Describe your problem.

3. Describe the computing platform(s) that you plan to use (processor type, clock rate, memory available, number of cores, network interconnect, GPU (if available), etc.)
4. What type of hybrid parallelism do you plan to use? Name specific ways/tools by which hybrid parallelism is accomplished.
5. What are the foreseen *objective* difficulties? (e.g., Is your problem memory-bound, compute-bound, or cannot be scaled up easily? Are all the needed tools available?)
6. What analyses are planned? What analysis tools will be used and why (e.g., linear regression, statistical packages, parallel benchmarks, performance monitoring tools)?
7. What application and computer architecture parameters may be possible to tune for your application? (e.g., problem size, number of cores/threads, number of GPUs).