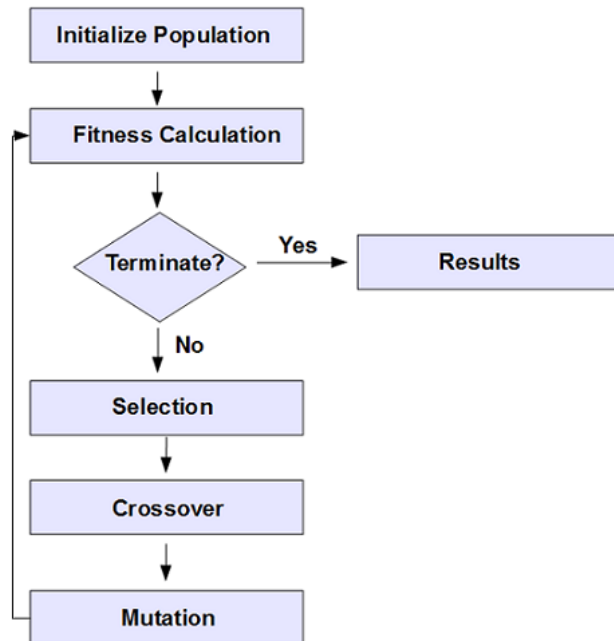




In the Name of God
Parallel Algorithms, Spring 2020
Homework #5: CUDA

Due date:

Genetic Algorithm (GA) is a method of solving optimization problems by simulating the process of biological evolution. GAs are excellent for searching through large and complex data sets for an optimal solution. The following figure depicts its flowchart:



In this homework, you are supposed to write a GA with CUDA to find “HELLO WORLD” form alphabet letters. In other words, the phrase “HELLO WROLD” is the optimal solution, and all the possible genes are letters “A” to “Z” and “ ”. You can model each Character as a Gene, and consider the Chromosome Length as 11.

- At first, you should generate a list of possible solutions (Initialize Population).
- The fitness criterion for this problem is the similarity of each chromosome to the phrase “HELLO WORLD”, and you should define a fitness score for each chromosome.



- In the Selection phase, you have to sort all chromosomes based on their fitness score and **select a percentage of better chromosomes for the next iteration** of the algorithm.
- You are free to implement a good policy for the Mutation and Crossover phases (Single point is the simplest way).
- You should test your code with **different Initial populations (100, 500, 1000, 10000)**, and report the execution time for each.
- Finally, you should profile your codes using NVIDIA Visual Profiler or **nvprof** and **analyze the results** provided, and **determine what have you done to improve the performance according to your analyze.**
- **(20 % Bonus)** You can use CUDA streams for transferring data between host and device.
- You should write a complete report in **PDF** format, including:
 - Your computer's specifications (including your GPU model and its specifications like the number of CUDA cores, dynamic RAM, etc.)
 - A complete analyze of your profiling
 - An explanation of how to run your code (Linux command to run your code)
 - An explanation of your approach for parallelizing the program (the number of kernels, etc.)
 - A comparison between the execution time of your code in Serial and Parallel for each input configuration (different number of CUDA streams [Bonus], Initial population, and Block Size), and calculate speedup for each input.

Reminders:

- Each HW has to be done individually (**For assignments that are similar to each other, the grade is 0.**)
- 50% of your points belong to the report.
- Your codes and the report should only be submitted before the due date through email to TA (majidsalimib@gmail.com) with the "homework number" as the subject of email.
- Submitting your homework late will reduce your score by a percentage for each day.
- In-person delivery will be announced.