CENG 443 Parallel Programming II - Take-Home Final Exam 07.01.2024

(70 Pts) Part I : Programming (Power method):

You will develop the same program in your project, however this time you will use the OpenCL library. If you are facing problems using OpenCL on your PC, we can give you an account on our server.

- In this part, you must implement the Power method and print out the eigenvector to a file named ‘eigenvector.txt’ and the respective eigenvalue to the screen.
- You will use the same matrices. Write a PDF report in LATEX and compare your timings with your MPI and OpenMP programs in a table.
- Create 2 other tables that show your speed-up and efficiency values.
- Discuss your results in one paragraph.
- You must write kernels for matrix-vector multiplication and parallel 2-norm calculation.
- If you implement the Shifted Power Method, you will gain +10 extra point. For this part you must write a kernel for matrix subtraction.
- Your program must run on the Linux environment and you must use the C Programming language.
- Submit a zip file that includes your source code, compilation commands (or Makefile) and your report.

(30 Pts) Part II: Essay questions (These are the same questions of last year's exam).
You must add the answer of these questions at the end of your LATEX document in PDF.
Use your own sentences while answering the questions.

1. Explain round-off error and machine epsilon. Why are these important when dealing with high-performance computing?

2. What are the differences between OpenCL and Cuda?

3. In parallel computing, why are iterative solvers preferred for solving large sparse linear systems instead of direct solvers? Discuss and give at least 2 reasons.