Alexandria University
Faculty of Engineering
Computer and Systems Engineering Department

Parallel Computing
Assigned: Saturday, 11/3/2023
Due: Saturday, 18/3/2023

Lab Assignment 02

Objectives

Reperesenting efficientcy and iso-efficiency lines using Mathematica . Getting familiar with Qiskit.

Part 1:

Problem Statement

The following graph represents dependency of the scaled efficiency $E\gamma(p) = S\gamma(p)/p$ parameterized with $\gamma = p^{\delta}$. The parameter δ is sampled from the interval [0, 1] referring to Amdahl' law for $\delta = 0$ and Gustafson's law for $\delta = 1$. The six curves in the p–δ plane are projected iso-efficiency lines of $E_{\gamma=p^{\delta}}(p)$. Obviously, we have to significantly increase the degree δ of the functional dependency of the scaling ratio $\gamma = p^{\delta}$ in order to preserve efficiency when increasing the number of processing units p.

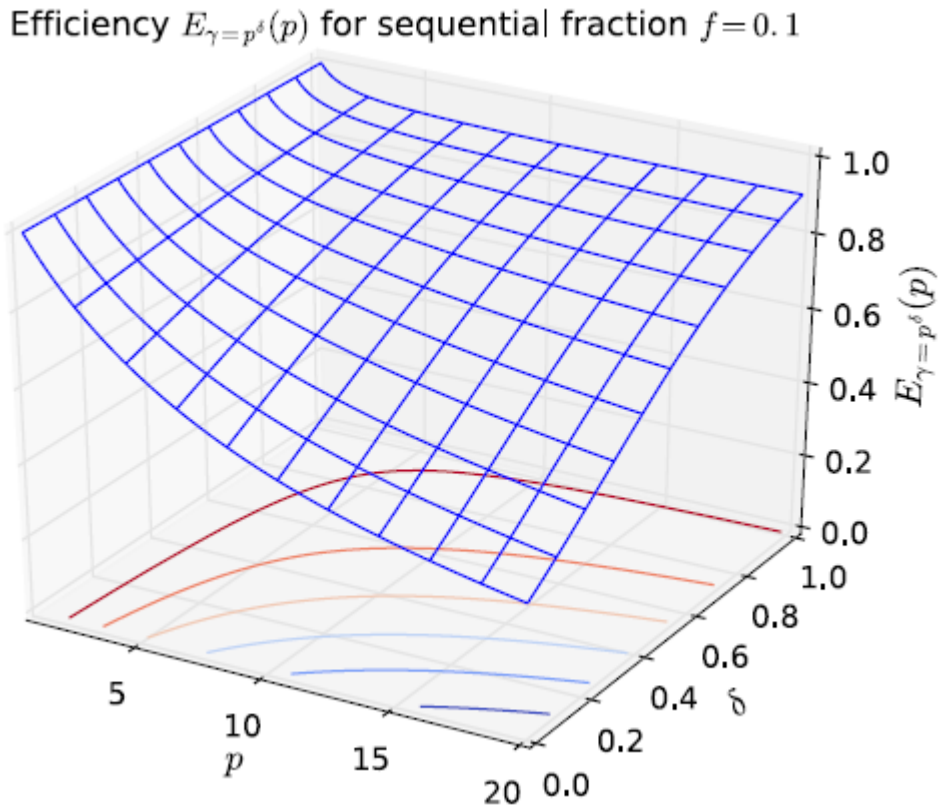

Figure 1

Part 2:

Problem Statement:

A **full-adder** is a combinational logic circuit that can add two binary (bits) and a carry bit, and produces a sum bit and a carry bit as output as shown in following figure 2.

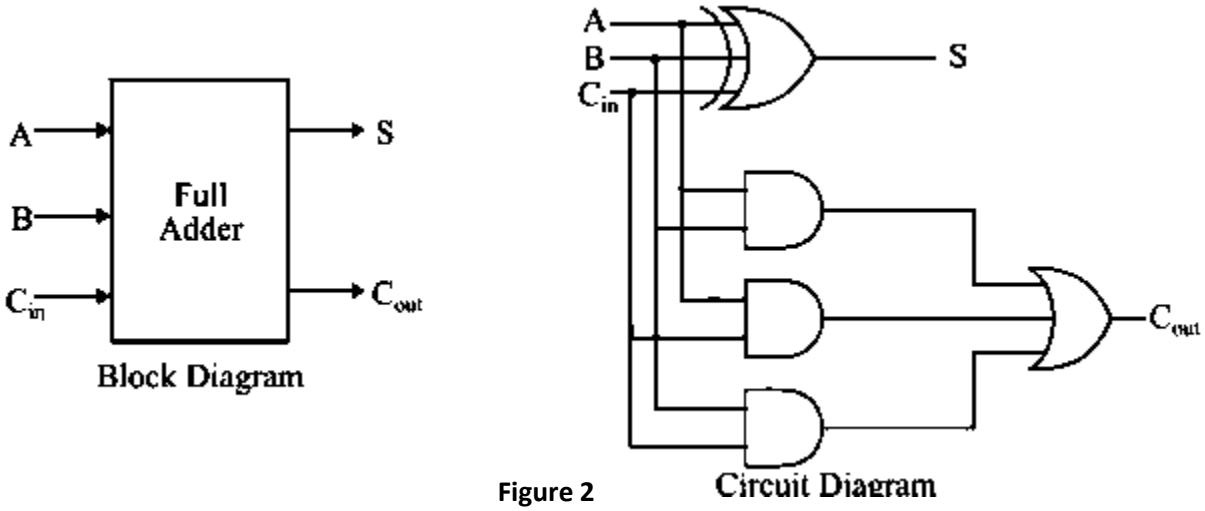

Figure 2

Requirements:

- Part 1:
  - Plot Figure 1 with iso-efficiency lines of efficiency values = [0.25, .50, .75, .9].
- Part 2:
  - Install Qiskit
  - Implement a full adder using Quantum simulation.
  - You could use only (x, cx, ccx) quantum operations to implement logic gates.
  - For each logic gate, simulate it using IBM quantum composer

Delivery Policy

- You should work individually.
- You should submit a report describing your code flow, screenshots of working code, IBM simulations and challenges you faced (if any).
- You should submit Mathematica notebook.
- You should submit Jupyter notebook or Python file including Full-Adder code.
- You should cite any additional resources you used.
- Further details for the submission instructions will be posted later on MS Teams.

Good Luck