جامعة بيرزيت
BIRZEIT UNIVERSITY

Department of Electrical and Computer Engineering
Second Semester, 2023/2024
Artificial Intelligence, ENCS3340

Project #1: Optimizing Job Shop Scheduling in a Manufacturing Plant using Genetic Algorithm

Due date: May, 11, 2024
Late submission: 20% per day.
Teams: This project is intended for teams of 2 students. You can work with students from any section

Consider a manufacturing plant with several machines such as cutting machines, drilling machines, and assembly stations. Each product requires a sequence of operations on these machines. The scheduling problem here is to determine the optimal sequence and timing for each product to minimize the overall production time or maximize throughput while considering machine capacities and job dependencies. This project aims to develop a genetic algorithm to optimize job shop scheduling in a manufacturing plant setting.

Requirements:

- Implement a system for job shop scheduling using genetic algorithm. The system takes as input a list of jobs and the number of available machines (Assume each machine can run only one job at any moment). The job is defined as a sequence of operations, where each operation is specified by a machine to perform this task and the required processing time. The sequence of operations for a given task has to be performed in order. Here is a sample of the input to the system

  Job_1: M1[10] -> M2[5] -> M4[12]
  Job_2: M2[7] -> M3[15] -> M1[8]

  Here Job_1 must start at machine M1 and requires 10 time units to finish the first phase, then it requires 5 time units at M2 and ends with 12 time units at M4. Whereas Job_2 starts at M2 and needs 7 time units, and so on.

- To test the system, the user should be able to specify the number of machines and the list of jobs with their operation sequences. You can use any format for the input and you do not need to stick with the format presented in the previous sample.

- The output of the system is a schedule for each machine that depicts the start and end time for each process and to which job it belongs. You can use Gantt Chart for this purpose.

Submission:

- Source code.

- A report (**.pdf**) of up to *3 pages* that describes your *problem formulation*, including chromosome representation, cross-over, mutation, and the used objective function. Make sure to include *test cases* in the report as well.

- Demo: you will be asked to present a demo of your project. During the demo, you should expect questions about your code and you might be asked to apply some minor modification.

Create one **zip file**, containing all files for your project (including source code and report). Name your zip file this way: **studentID1_studentID2**

Honor Policy: All are required to adhere to the university honor policy and violations will be dealt with according to university regulations.