German University in Cairo (GUC)
Faculty of Engineering & Materials Science (EMS)
Mechatronics Department (MCTR)

MCTR 1021 – Optimization Techniques for Multi-Cooperative Systems Course   *Winter 2025*

Project Milestone 4

Milestone	Brief Description	Deadline
4: GA (8%)	Implementation of Genetic Algorithm (GA) on your problem.	Week 10: Sunday, **16 November 2025**

Milestone 4 Objectives:

1. Genetic Algorithm (GA) Implementation:
   - Based on the problem formulation, implement GA for your project topic using appropriate algorithm parameters (e.g. population size, etc.).
   - Visualize the resulting solutions via illustrative figures.
   - Validate the algorithm by testing on case studies and comparing to results from previous literature or known benchmark problems tackling the same problem.
   - Test the algorithm on different case studies of varying sizes and complexity.

2. Progress Report:
   - Explain and illustrate your implementation of the algorithm for your problem (e.g. via algorithm pseudocode or flowchart); including problem-specific considerations (e.g. crossover methods).
   - Describe all case studies and specify the used input parameters for each case study.
   - Report and discuss the results of your algorithm validation.
   - Report and discuss all obtained results of each case study.
   - Analyze and discuss the algorithm's performance and the effect of the different algorithm parameters on its performance.
   - Compare the resulting solutions and performance of both implemented algorithms, SA and GA, using different performance indices. It is preferable that the performance indices are specific to your specific problem so that they are expressive of the quality of solutions generated.

Programming Languages:
   - In case Python was the chosen programming language, you may use MATLAB only for generation of graphs, figures, or charts.
   - Your codes should be runnable on any machine (i.e. usage of toolboxes/packages is not allowed).

Minimum Requirements:
   - Implementation of GA on your problem.
   - Visualization of resulting solutions.
   - Validation of results.
   - Comparison of SA and GA results using two different performance indices at least.

Deliverables:
1. Progress report (in provided template) in accordance to objectives above.
2. Your implemented codes for GA and for all case studies and results.
3. Screen-recorded video of your codes running and the codes' results including the visualization of the results with narrated comments.

Dr. Eng. Omar M. Shehata
Eng. Jessica Magdy ,Eng. Mohamed A.Ibrahim, Eng.Dalia M. Mahfouz,
Eng. Mohamed Ashraf, Eng. Abdelrahman Yasser

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Submission Deadline:

- The deadline of Milestone 4 submission is on **Sunday, 16 November 2025, at 23:59**.
- The milestone will be graded based on several criteria including **but not limited to**:
  - Quality of all submitted material.
  - For codes implementation: scalability, modularity, documentation (i.e. well commented), etc.
  - For results analysis and discussion: analysis of results (numerical, graphical, performance metrics, parametric studies, statistical studies, etc.) in light of the specific problem on-hand; as well as commenting on noticed trends and ability to highlight recommendations for improvement.
  - For reporting: clarity of presentation and professional discussion with multiple aids (e.g. block diagrams, flowcharts, figures, tables, graphs, charts, etc.). Equations should be written professionally with proper identification of nomenclature.

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