

# EE6227: Programming Assignment 1

This programming assignment offers some choices for the students. Most of the codes are available online. The final submission must include the following:

1. Descriptions about at least two algorithms used in the study. In the case of single objective bound constrained optimization, for example, basic differential evolution and an improved version can be used. Alternatively, the basic PSO with momentum term and CLPSO (or HCLPSO) can be used. **With the algorithmic descriptions, the corresponding short code segments can be included.** Codes of CLPSO, HCLPSO and some other algorithms are available from: <https://github.com/P-N-Suganthan/CODES>
2. Total number of Fitness/objective function evaluations per run can be 50,000 for 10D (decision variable) problems.
3. **Descriptions about the important parameters of the chosen algorithms and how they were tuned. Tuning experiments can be conducted using 5-10 repetitions, on 4-5 problems. ANOVA or iRace may also be used for algorithmic parameter tuning.**
4. After tuning the important parameters, final runs can be repeated 30 times.
5. 10 problems can be selected (out of 25+ benchmark problems) with 10 decision variables.
6. If a Real-world problem benchmark is used, 10 problems with 7 or more decision variables can be selected. **Selected problems can be briefly described in a few sentences.**
7. Tables of results can include mean, median, standard deviation, convergence plots, etc.
8. Convergence plots show objective value (Y-axis in log scale) versus number of function evaluations (X-axis linear scale).
9. Statistical testing can be conducted using Wilcoxon signed-rank test or another suitable test.
10. Conclusions can be made.

## Suggested test problems are:

1. **CEC 2017 bound constrained benchmarks**
2. CEC 2017 constrained benchmark (a constraint handling method must be used too)
3. CEC 2011 Real-world numerical optimization problems (bound constrained problems)
4. CEC 2020 Real-world constrained optimization problems. (a constraint handling method must be used too)
5. CLPSO numerical optimization problems (bound constrained problems) available from <https://github.com/P-N-Suganthan/CODES/blob/master/2006-IEEE-TEC-CLPSO.zip>

You need to select only one of the above 5 problem sets. Within the selected problem set only 10 problems with 10 (or slightly larger than 10) decision variables should be used.

[https://www.ntu.edu.sg/home/epnsugan/index\\_files/cec-benchmarking.htm](https://www.ntu.edu.sg/home/epnsugan/index_files/cec-benchmarking.htm)

Codes of several algorithms, benchmarks, etc. are available mostly in Matlab or C from:

<https://github.com/P-N-Suganthan?tab=repositories>

All reports should be typed and uploaded to the turnitin submission page in NTULearn. All reports must be original. Turnitin will do a similarity check (comparing with millions of documents) and highlight identical texts. **Handwritten submissions, picture/image submissions, email submissions are not accepted.**

**Deadline: 8 Mar 2021**