EE 496 HOMEWORK #2

Assigning Students to Courses using Genetic Algorithm

Due: 26/5/2017

*For questions, contact the TA. Kamil Sert - EA 405 - ksert@metu.edu.tr

Problem Statement

The purpose of this homework is to assign each on N students to one of K courses with limited capacity. Students indicates their preferences. Our aim is to maximize satisfaction of preferences as far as the following constraints permits:

1) Each student should be assigned to exactly one course
2) Course capacities should not be exceeded

Description of input meta parameters:

Number of offered courses: K=4
Maximum capacity of courses: 8 students
Crowdness depends on number of total students (N)
a) Low: N=20
b) High: N=30

Popularity of courses (vector): Popularity[4]

a) Balanced: Popularity=[5, 5, 5, 5]
a) Unbalanced: Popularity=[10, 5, 5, 2]

Elective course preference simulation:
Preference[N, 4] is the matrix indicating course preferences of the students. P[k, -] is the row vector showing the preference of student k, each component having preference value.,
For example; P[k, -]=[2, 1 , 4, 3]

Selection of 1st preference: One of the courses i=1…4 is selected randomly according to distribution Pi=Popularity[i] / (sum(Popularity[k], k=1…4))
Selection of the other preferences: Remove the selected course from the course set, and repeat the selection considering popularity of the remaining courses.

EA metaparameters (Population size, Crossover rate, Mutation rate, tournament size etc.) are to be determined by experimentation.

Selection of parents for crossover: Tournament selection
Selection for next generation: Roulette wheel

GA Algorithm Input:

Crowdness, Popularity
A randomly created Preference matrix
Meta parameters (suggested values)
How many generations to continue (0 means stop)

GA Algorithm Output:

- For each generation repeatedly show:
  - Generation number
  - Calculated Cost for the best chromosome
  - Fitness of the best chromosome
- If number of generations completed, show the solution:

Class lists for each course, which is the solution represented by the best chromosome, together with information on preference for the course assigned

- Ask how many generations to continue (0 means stop)
- If 0 entered then plot fitness vs generation no and then stop

Example for Input:

Crowdness=Low,
Popularity=Unbalanced

PREFERENCE

	C1	C2	C3	C4
S1	1	2	3	4
S2	2	1	3	4
S3	1	3	4	2
S4	3	1	2	4
S5	1	2	4	3
S6	2	3	1	4
S7	1	3	2	4
S8	3	1	4	2
S9	4	1	2	3
S10	3	1	2	4
S11	1	2	3	4
S12	2	1	3	4
S13	1	3	2	4
S14	4	3	1	2
S15	3	2	1	4
S16	2	4	1	3
S17	1	2	4	3
S18	3	4	2	1
S19	1	3	2	4
S20	1	2	3	4

Population size: ...
Cross over rate: ...
Mutation rate:...

Example for Output:

GENERATION: ..
COST=2
FITNESS= ..

CLASS LISTS

	C1	C2	C3	C4
S1	1			
S2		1		
S3	1			
S4		1		
S5	1			
S6			1	
S7	1			
S8				2
S9		1		
S10		1		
S11	1			
S12		1		
S13	1			
S14			1	
S15			1	
S16			1	
S17	1			
S18				1
S19			2	
S20	1			

How many generations to continue (0=stop) ? :

If 0 entered then Plot fitness vs generation no

(*) Cost is calculated as sum(Preference-1) over all students considering class listst

Experiments

For Crowdness={low, high} and Popularity={balanced, unbalanced} cases repeat the followings:

1) Generate 10 random Preference matrix using provided matlab code.
2) Considering Preference matrices generated in step1, search for genetic algorithm meta parameter values and decide on the values of the parameters;
   Population size:
   Cross over rate:
   Mutation rate:
   If there are other parameters also list them and their values.
3) Prepare fitness versus generation plots considering the best chromosome of for your report. In the plots you should consider average for 10 random Preference matrices. Your report should show:
   a) *Effect of population size* (keep all the other meta parameters same as the one chosen in step 2), but change population size (3 different values) to show the effect. One of the population size should be same as the chosen in step 2.
   b) *Effect of Cross over rate* (in the same way explained above)
   c) Effect of Mutation rate

***** You can reach the tutorial for GA toolbox via following link
https://youtu.be/qVHd6T-lSL0

Your report

Introduction:
Give a short description of the problem.

Method:
Explain what is your chromosome, how cost and fitness are calculated, how the constraints are handled in your fitness function. Also give a short pseudo code explaining how you applied EA. How you measure performance.

Experimental results:
Present the plots that you obtained in the experiments.

Conclusions:
Write your conclusions on what you obtained.

What to deliver?

Deliver one single zipped folder that includes:

- PDF report
- Source code
- Data file

Remarks

1) Name your zip file as EE496_HW2_<st.id>_<SURNAME>_<Name> (Example: EE496_HW2_e201969_YAMAC_Gunes.zip)
2) **Cheating is strictly forbidden**. You are not allowed to deliver together or copy/share source-code or answers with others.
3) Late submissions are welcome, but penalized according to the following policy:
   - 1 day late submission: HW will be evaluated out of 70.
   - 2 days late submission: HW will be evaluated out of 50.
   - 3 days late submission: HW will be evaluated out of 30.
   - 4 or more days late submission: HW will not be evaluated.

Good luck !