COMP304: Artificial Intelligence
Assignment Two
Due Date: 5 November - 13:00

Write a program using a Genetic Algorithm to solve the delivery problem below:

The Delivery Problem:

A Delivery company has a set of boxes to deliver. Each box has a value and a weight. It has one delivery vehicle. You are given a capacity c, which is the maximum total weight that can be transported and a quota q, which is the minimum total value v that you want to carry at any one time. The problem is to find a subset of the objects whose total weight w is at most equal to the capacity ($w \leq c$) and whose total value is at least equal to the quota $v \geq q$.

For example, given these three objects:

Object	Weight	Value
A	70	80
B	50	50
C	50	50

and a capacity of 110 and a quota of 90, then a solution to the problem is the set $\{B, C\}$. Note that there is no solution involving object A, because once you have loaded A, you cannot load any of the other two. (You are not allowed to choose a fraction of an object.)

The program should take its input from an input file that will contain a number of problems in sequence. Each problem has the following format.

- First line: ***

- Second line: Capacity.

- Third line: Quota.

- Fourth line: Number of objects

- Remaining lines: 1 line per object. Name, weight, and value, separated by blanks.

There can be any number of blank lines separating problems. You may assume that:

- There are at most 20 objects.

- A name is a single alphabetical character.

- All quotas, capacities, weights, and values are integers.

An input file containing one example will have the following form:

```
***
100
400
9
A  70 260
B  60 245
```

```
C  50 200
D  40 100
E  30 80
F  20 65
G  10 60
H  10 60
I   1 10
```

Your programs should output the solution set, the total weight and the total value. Also output the generation in which the solution was found.

Specifications

1. Design and implement the program (using a genetic algorithm) as specified above.

2. Sample input is given in a text file (input.txt).

3. Write a report detailing the following:

    (a) Describe a chromosome in the initial population and the population size used.

    (b) Define the fitness function you used.

    (c) Describe the selection method used.

    (d) Describe the mutation operator and the mutation rate used.

    (e) Describe the crossover operator and the crossover rate used.

    (f) Describe the termination criterion.

Notes:

- Use either Java or python to implement the program.

- Submit both the source code and you must submit executable programs that runs without the IDE being installed on the user's system.

    - Java programs: Submit a jar file or the class files that will run. Ensure that the jar/class files can be run on a machine with only the JDK installed (i.e. without the IDE that you have used to create the program). 5 November

- The interface can be text-based or graphical.

- Programs that do not run will be allocated a mark of zero.

Submission

- The assignment **must** be submitted on or before 5 November - 13:00.

- You must use the Course website to submit. Click on **Assignments** in the Activities block (top left). Then click on **Assignment Two**. You will be taken to a page which allows you to upload a file. You can re-upload a file but this will overwrite any file that was previously uploaded.

- Please be warned against plagiarism. This is an individual assignment and group work is **not** permitted. The school has access to software to check for plagiarism. Cases of suspected plagiarism will be submitted to the University proctor.