

Technical Annex

You are supplied with some Java code that:

- Provides the means to evaluate a cycle race given a particular transition and pacing strategy
- Provides a very simple evolutionary algorithm that only evolves the transition strategy (leaving the default pacing strategy fixed) to indicate how to use the code. This is by no means an optimized algorithm in terms of either its operators or its parameters and is only provided by means of example.

You should only need to alter the classes in the EA package:

- ***EA.java***
- ***Individual.java***
- ***Parameters.java***

If you don't want to use the classes above, feel free to write your own code.

However, you must use the classes below which provide the simulation of the cycle race. Please do not attempt to rewrite these in a different language.

The ***teamPursuit*** package supplies the simulation of the cycle race. You should not alter anything in this package. For interest, the classes are outlined below:

1. A default team is initialised by creating an instance of the ***WomensTeamPursuit*** class. You should not alter any information in this class. For interest, the team has *three* cyclists with *exactly the same attributes*:
 - a. Height: 1.6m
 - b. Weight: 65kilos
 - c. MeanMaximumPower: 5 Wm^{-1} (the power a rider can output is their mass multiplied by this constant).
2. The ***Cyclist*** Class defines the following variables: you should not alter any of these values.
 - a. ***MAX_POWER*** = 1200;
 - b. ***MIN_POWER*** = 200;
 - c. ***DRAG_COEFFICIENT*** = 0.65;
 - d. ***MECHANICAL EFFICIENCY*** = 0.977;
 - e. ***BIKE_MASS*** = 7.
3. The ***TeamPursuit*** class defines the physics: you should not alter any of this information
 - a. ***FRICTION_COEFFICIENT*** = 0.0025;
 - b. ***DRAFTING_COEFFICIENTS***[] = {0.75, 0.65, 0.55};
 - c. ***GRAVITATIONAL_ACCELERATION*** = 9.80665;
 - d. ***TIME_STEP*** = 0.001;
 - e. ***TRANSITION_TIME*** = 0.12;

```
// Environmental Attributes
f. temperature = 20.0;
g. barometricPressure = 1013.25;
h. relativeHumidity = 0.5
```

4. The default strategies are set to the following:

There are 22 possible transitions:

```
DEFAULT_WOMENS_TRANSITION_STRATEGY = {true, true, true,
true, true, true, true, true, true, true, true,
true, true, true, true, true, false, true, true, true,
true}
```

There are 23 segments, each of which has a pace associated with it (power):

```
DEFAULT_WOMENS_PACING_STRATEGY = {300, 300, 300, 300, 300,
300, 300, 350, 350, 300, 300, 350, 350, 350, 300, 300,
350, 350, 350, 350, 300, 300};
```

You should not alter the number of transitions or segments.

Hints

Pacing Strategy

If you randomly initialize both the transition strategy and the pacing strategy, most solutions are likely to lead to situations where you run out of energy before the race is finish. You might want to consider some of the following:

- initialising pacing strategies within a restricted range in the starting population
- having mutation operators that only alter the power by a small amount

Note that the minimum power you can use in the pacing strategy is **200** and the maximum is **1200**.

Fitness Function

The supplied fitness function gives a score of 1000 to all solutions that do not result in the race being completed, regardless of how much of the race was actually completed.

Consider methods by which you can alter the fitness function to give more credit to solutions that nearly finish the race than solutions that do not get anywhere near completion.

Comparison

In your report, you should compare your result to that obtained using both of the default strategies (**263.268 seconds**) and report the % improvement of your method over this.