COMPARSIONS

An OO - Approach to ARGESIM Comparison C16 'Restaurant Business Dynamics' with JAVA

H. Hötzendorfer, C. Mayer; Vienna University of Technology

{hhoetz, ccmayer}@osiris.tuwien.ac.at

Simulator. Java is a widely used and platform independent programming language. A big advantage is the vast amount of freely available packages. For the realization of the graphical representation the package ptplot 5.3, provided by the UC Berkeley, was used.

Model. Due to the fact that the given problem is not time-critical, which means that the orders of people having dinner or of opening and closing restaurants are not decisive, there is no need for elaborated event-handling. Therefore, a straightforward object-oriented approach was used for the simulation.

In accordance to the definition it is obvious to define two different classes for restaurants and persons:

Restaurants: For each instance of the restaurant class the weekly revenue is accumulated and at the end of every week the profit is calculated by subtracting the taxes and the running costs. Afterwards, the policy for deciding to open a new restaurant or to close the inspected one is applied (either a new instance is generated or an existing is deleted).

Persons: Each instance contains information considering the position and the next dining date. Although there is neither spatial movement nor change in the population number, a separate class was developed for a possible extension of the model.

The algorithm for the update at a restaurant visit shows efficient but hard-to-read Java code:

```
public void visitRestaurant(double[] darrXYp){
  Vector vPossibilities = new Vector();
  for (int i = 0; i < vRestaurants.size(); i++) {
  double[] darrXYr = ((Restaurant)(vRestaurants
    .elementAt(i))).getXY();
  double dDist = Math.sqrt(Math.pow((darrXYr[0] –
  darrXYp[0]), 2) +
  Math.pow((darrXYr[1] - darrXYp[1]), 2));
    if (dDist < iRange) {
      vPossibilities.add(new Integer(i));}
```
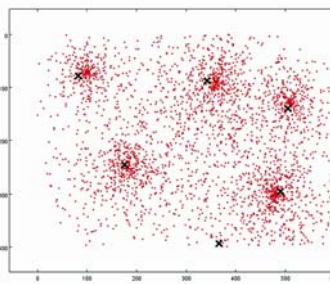

Figure 1: Spatial distribution of restaurants

Task a - Time Domain Analysis: Because of the influence of stochastic opening and closing decisions, multiple (e.g. 50) simulation runs have to be performed to get a meaningful result. Nevertheless, single simulation runs have been performed for different time periods resulting in a value of 6 restaurants after 1, 7 after 5 and 6 after 10 years.

Results at the end of the fifth year for a simulation over 50 runs are shown in the table. Fig. 2 shows the temporal evolution of restaurants and one can easily see that the number of restaurants remains at a level between 5 and 6 after a warm-up period of about half a year.

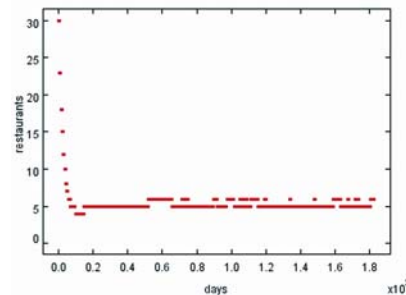|	
Mean	6.06
Min	4
Max	9
Variance	2.02
Deviation	1.42

Figure 2: Total number of restaurants (5 years, 50 simulation runs)

Task b - Tax Income Maximisation. To maximise the tax income we have simply varied the tax rate with a step width of 1%. A reasonable maximum in the interval [30, 45] can be noticed with a steep decrease following due to the fact that higher tax rates would not allow economical survival of restaurants. A maximum overall tax income of 90911.55 after simulation over 2 years with reduced step width (0.1%) in the given interval corresponds to a tax rate of 37.8%.

Task c - Restaurants' Revenue Analysis. Once again, variation of the parameter of interest has led to maximal revenue for new restaurants. Figure 2 shows the dependence of the weekly revenue of the parameter *k*. A maximal value (714.67) has been achieved at a value of *k* = 1.0.

Figure 3 – Average weekly revenue of new restaurants
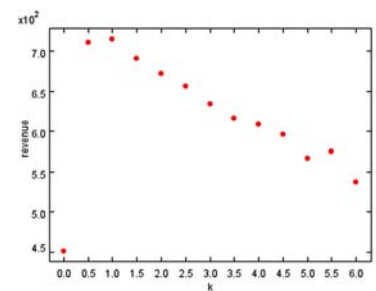
C16 Classification: Object Orient., Programmed

Simulator: Java 2.0