



A Transaction-Oriented Approach to ARGESIM Comparison C6 ‘Emergency Department- Follow-up Treatment’ using GPSS World

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Simulator. GPSS World is a high powered general purpose computer simulation environment, designed for recurring use by simulation professionals. It is a comprehensive modelling tool covering mainly discrete computer simulation. GPSS World is based on the well known very fast compiling simulator GPPS, controlled by a comfortable Windows environment.

GPSS World is object oriented, based on so-called transactions (of entities through blocks). Its inhabitants include *Model Objects* which are used to create Simulation Objects. *Simulation Objects*, in turn, are used to play out simulations and create *Report Objects*. Finally, *Text Objects* can be used as include-files to support code sharing and a user source code library and they are often used as files which can be read from or written to by the simulation.

Model: An emergency department is modelled, where four kinds of causalities are admitted for patients. Their way through Causality Ward, X-ray and Plaster Room depends on the severity of their wounds.

Figure 1 shows the textual model environment of GPSS World. There several BLOCK commands can be written to model all needed transactions.

```
C6 task a.gps
GENERATE (EXPONENTIAL(1,0,18))
QUEUE qall
ASSIGN ent,0
ASSIGN cw,2
ASSIGN rvalcw,(UNIFORM(1,0,1
regist SEIZE regstr
ADVANCE V$timereg
RELEASE regstr|
patient ASSIGN rval,(UNIFORM(1,0,1))
TEST GE P$rval,0.35,first
TEST GE P$rval,0.55,second
TEST GE P$rval,0.6,third
```

Figure 1: GPSS World model, routing of patients (entities) through stations (blocks)

Special values are assigned to the generated transactions, telling which kind of patient the transaction represents. Depending on these values, the transaction makes their way through the system. Every time a patient transaction exits a treatment point, new values are assigned.

The statistical evaluation is automatically performed by GPSS World and shown in the report after the simulation. Therefore QTABLE commands and QUEUE Blocks are used.

Task a – Classical Sequential Strategy.

Depending on the type of patient the treatment time takes between 93 and 209 minutes, with overall treatment time of 381 minutes (detailed results in Figure 1).

Task b - Doctors’ Exchange Strategy.

As soon as the queue before causality ward 2 contains more than 20 patients the more experienced doctor takes over.

This strategy yields an increase of treatment times for all types of patients, for the standard deviation, and also for the overall treatment time.

In task a and in task c the doctors are realized by STORAGE Blocks. In this case four FACILITY Blocks have to be used to model each doctor, in order to model independent treatment times. The changing of the doctors is implemented by TEST and SAVEVALUE Blocks.

Task c - Priority Strategy.

The patient transactions get the PRIORITY 1 if they are leaving the causality wards after treatment. Depending on this marks, a priority ranking is established in the queues (standard feature in GPSS World).

Results show a decrease in treatment time for patients of type 1 and 3, an increase for the others. The standard deviation and the overall treatment time decrease (Table 1).

| mean time | task a | task b | task c |
|----------------|--------|--------|--------|
| patient 1 | 199 | 214 | 120 |
| patient 2 | 94 | 102 | 134 |
| patient 3 | 209 | 220 | 140 |
| patient 4 | 93 | 99 | 116 |
| Std.dev. (1-4) | 83 | 92 | 72 |
| ov.treat.time | 381 | 414 | 364 |
| close hour | 13:51 | 14:24 | 13:34 |

Table 1: mean treatment times of individual patient types, standard deviation for patients 1-4, and mean for overall treatment time - depending on routing strategy

Classification: Transaction-oriented DEVS Approach
Version: GPSS World 2005, Student Version