

Pramod Parajuli

Simulation and Modeling, CS-331

Chapter 12

GPSS Examples

Priorities and Parameters

- All Transactions are processed in same manner
- Transactions have two types of attribute which influence the way they are processed
 - 128 level of priority (0 – 127), 0 - lowest priority
 - Parameters

Priority

- Priority can be set up or down to any levels by PRIORITY block
- Priority can be set by using 'E' field of generate block. Blank field denotes zero priority
- If there is competition between transactions to occupy a block, priorities are measured. Within same priority, first in, first out

Priorities and Parameters

Parameters

- Parameters are characterized by numerical data
- The values are identified by the notation **Pxn** where 'n' is parameter number and 'x' is the type.
- x can be; F, H, B, L for full word, half word, byte, floating point respectively
- If no declaration made, 12 halfword parameters are assigned – PHn
- All parameter values are zero at the time a transaction is created
- A value is given to the transaction when it enters an ASSIGN block
- The number of parameter is given in field 'A' of ASSIGN block.

Priorities and Parameters

Parameters

- The value of parameter is given in field 'B'
- Value can be specific number of SNA
- Field 'C' indicates type – F, H, B, L
- + sign adds to, - sign subtract from, and number replace the value of the parameter

Standard Numerical Attributes (SNA's)

Contains

- One or two letter code
 - A number
- 'Storage number 5' is denoted by S5
- 'Length of queue number 15' is denoted by Q15

SNA's combined with operators can form variable statements

myVariable VARIABLE S6+5*(Q12+Q17)

Similarly, to define floating point, FVARIABLE

Recall 'M1' parameter to field 'A' of TABULATE – it is SNA

Current value of SNA can be used as the value of almost any field of a block

Value of SNA's are calculated at the time they are required.

The value is never maintained for future use

Standard Numerical Attributes (SNA's)

- To save value of SNA, SAVEVALUE is used.
- Field 'A' provides the number of one of many savevalue locations, and field B gives SNA to be saved.
- The roles of + sign and - sign are same as ASSIGN block
- Field 'C' specifies type – 'XF', 'XH', 'XB', 'XL'

SAVEVALUE 10, S6, XH

- Save contents of storage number 6 n halfword savevalue number 10
- Notation Xxn
- INITIAL can set the value of a savevalue at the beginning of the simulation. For the purpose, notation Xxn is put in field A and initial value in field B

Standard Numerical Attributes (SNA's)

C1	Current value of clock
CHn	Number of transactions on chain 'n'
Fn	Current status of facility number 'n'. 1- if facility is busy, 0 otherwise
FNn	Value of function 'n'.
Kn	Integer 'n'
M1	Transit time of a transaction
Nn	Total number of transactions that have entered block 'n'
Pxn	Parameter number 'n' of transaction, of type 'x'
Qn	Length of queue 'n'
Rn	Space remaining in storage 'n'
RNn	A computed random number having one of the values 1 to 999 with equal probability. 'n' = 1, 2, . . . , 8
Sn	Current occupancy of storage 'n'
Vn	Value of variable statement number 'n'
Wn	Number of transactions currently at block 'n'
Xxn	Value of savevalue location 'n' of type 'x'

Functions

- Introduce functional relationships in a model
- Each function defined by giving two or more pairs of numbers that relate an input x to an output y
- Function can be continuous or discrete
- In continuous, program interpolates between defined points to approximate the continuous function
- In discrete, function shows staircase property

Fig 10-1, Gordon

- Functions can take SNA's as parameter which can be treated as following;
 - By using uniformly distributed random number RN_n , as input, any other distribution can be obtained
 - By using clock time $C1$, action times can be made to depend upon clock time, thereby simulating the effects of peak loads

Functions

- By using the current contents of a storage, an action time can depend upon the current load on some part of the system
- By using a parameter, an action time can depend on each particular transaction
- The choice of parameter is made at function definition time
- Format of FUNCTION

Field	Contents
Location	Function number
Operation	FUNCTION
A	SNA to be used as input
B	Cn for continuous mode Dn for discontinuous mode where 'n' is the number of points to be defined

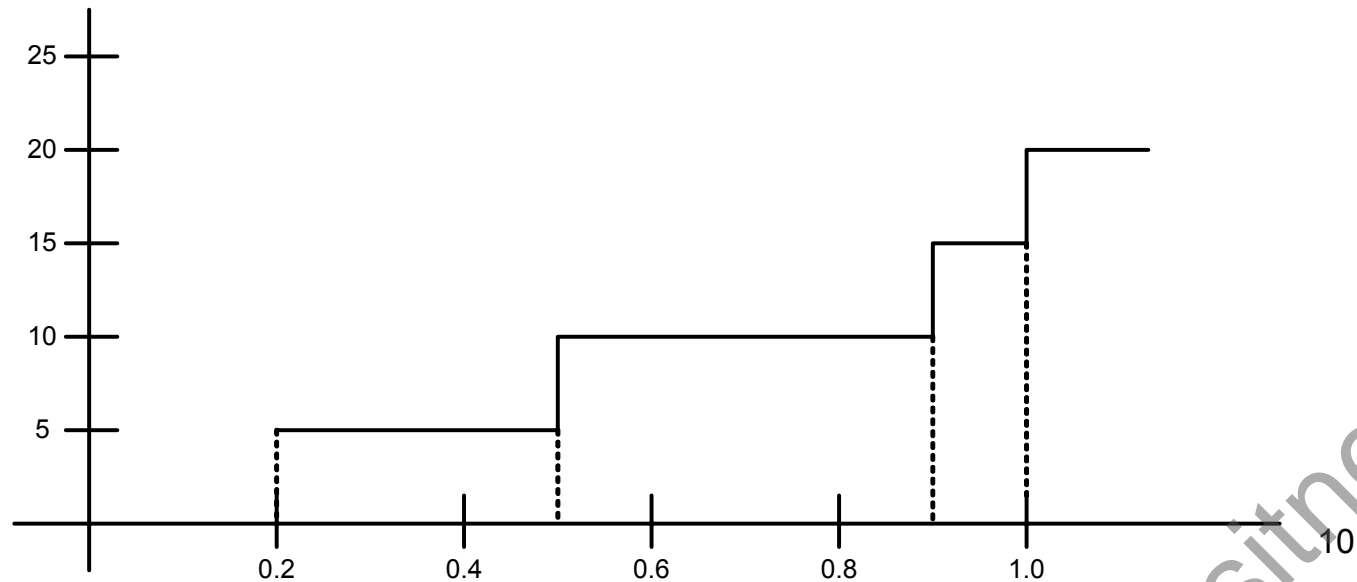
Functions

Example

myFunction FUNCTION RN1, D4
0.2, 5/0.5, 10/0.9, 15/1, 20

i.e. $x_1, y_1/x_2, y_2/x_3, x_4$

A plot of 'myFunction' will be;



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Transfer Modes

- To use parameter mode, Px is used in the 'A' field of the TRANSFER block, and parameter number is put in field 'B'
- For function mode, FN is put in field 'A' and function number in field 'B'
- If a number is put in field 'C', it is added to the parameter or function value
- A list mode function assumes that the input is an integer 'n' and it returns nth listed value of the function
- E.g. if transactions are to be sent to one of four locations called LOCA, LOCB, LOCC, and LOCD, and suppose one of the numbers 1,2,3,4, let's say 3, is placed in a parameter,

Transfer Modes

- Then;

TRANSFER FN, myFunc

.....

myFunc FUNCTION PH3, L4
1,LOCA/2,LOCB/3,LOCC/4,LOCD

L4 signifies that the function is in the list mode and has four listed values

Logic Switches

- Represent two state conditions in a system
- Each switch is either on or off
- Block – LOGIC
- Transaction entering the block either set the switch ON or OFF or invert
- S – set, R – reset, I – inverse
- Can be useful when status need to be checked before entering into next block

Testing Conditions

- Control flow of transactions
- GATE block is used for the purpose
- Symbols to represent conditions

LS n Logic switch 'n' set

LR n Logic switch 'n' reset

U n Facility 'n' in use

NU n Facility 'n' not in use

SF n Storage 'n' full

SNF n Storage 'n' not full

SE n Storage 'n' empty

SNE n Storage 'n' not empty

Testing Conditions

- Transaction enters GATE block if the condition being tested is true
- If condition is not true, there is choice of action
- If alternative block is specified, the transaction will be sent to the alternative block immediately
- If no alternative block, transaction waits for favorable condition
- TEST block can be used to test variety of relationships between any two SNA's

G	Greater than	GE	Greater than or equal
E	Equal	NE	Not equal
LE	Less than or equal	L	Less than

Set Operations

- An important requirement – capability of handling sets of temporary entities which have some common property
- Blocked transactions are automatically entered and removed from sets with a FIFO discipline
- Userchains are available and a transaction is placed on a chain when it enters a LINK block
- Field 'A' carries name/number of chain and field B indicates queuing discipline (FIFO,LIFO)
- If Pxn is used, transactions are ordered by ascending values of parameter number n, with FIFO rule for transactions having the same value
- While on chain, the transactions remain at the LINK block

Set Operations

- UNLINK block allows a transaction to remove transactions from the chain
- Field A – block name, field B – location to which unlinked transactions are to go. Field C specifies how the transactions are to be removed
- The count can be an integer, SNA, or 'ALL' to remove all transactions
- If only A,B,C are specified, program removes transactions from beginning of the chain
- JOIN allows a transaction to make itself a member of a group
- REMOVE allows a transaction to remove itself from the group

Set Operations

- SPLIT – allows one transaction to produce many copies which are automatically linked as a set but may proceed independently
- ASSEMBLE – gathers a given number of copies and merge them into one
- MATCH – synchronizes the movement of copies

Examples

Simulation of a Supermarket
Gordon – 227

GPSS Model of a Simple Telephone System
Gordon - 236