

RELIABILITY DESIGN



SIMULATION OF THE ALGORITHM

Consider a 4 stage system, where the devices have the following reliability.

DEVICE	RELIABILITY	COST in units of money
D1	.9	20
D2	.9	30
D3	.7	25
D4	.5	15

The budget is 130 units of money.

If we take one device as compulsory for each stage the cost is 90 units. The extra money available is 40 units.

If we take a choice as represented by $S(a\ b\ c\ d)$ as representing 'a' units of device 1, 'b' units of device 2, 'c' units of device 3 and 'd' units of device 4 the choices are as follows

$\{S_{1_}, S_{2_}, S_{3_}, S_{_1}, S_{_2}, S_{_1}, S_{_2}, S_{_1}, S_{_2}, S_{_3}, S_{_4}\}$.

STAGE I

S(1 __ __) = (cost of 90, reliability = .9)

S(2 __ __) = (cost of 110, reliability = .99)

S(3 __ __) = (cost of 130, reliability = .999)

STAGE II

S(_ 1 __) = (cost of 90, reliability = .8)

S(_ 2 __) = (cost of 120, reliability = .96)

Putting the first two stages together:

S(11 __) = (cost of 90, reliability = .72)

S(12 __) = (cost of 120, reliability = .864)

S(21 __) = (cost of 110, reliability = .792)

S(22 __) = (cost of 140-----COST EXCEEDED)

S(31 __) = (cost of 130, reliability = .7992)

S(32 __) = (cost of 160----COST EXCEEDED)

STAGE III

S(__ 1 __) = (cost of 90, .7)

S(__ 2 __) = (cost of 115, .91)

Putting the first three stages together:

S(111_) = (cost of 90, reliability = .504)

S(112_) = (cost of 115, reliability = .6552)

S(121_) = (cost of 120, reliability = .6048)

S(122_) = (cost of 145---COST EXCEEDED)

S(211_) = (cost of 110, reliability = .5544)

S(212_) = (cost of 135---COST EXCEEDED)

S(311_) = (cost of 130, reliability = .55944)

S(312_) = (cost of 155---COST EXCEEDED)

NOTE:- S(311_) can be deleted as cost increases compared to S(112_) or S(121_) but the reliability decreases.

S(121_) can be deleted as cost increases compared to S(112_) but reliability decreases.

This leaves only the choices S(111_), S(112_), S(211_).

STAGE IV

S(___ 1) = .5 reliability

S(___ 2) = .75 reliability at an extra cost of 15 units.

S(___ 3) = .875 reliability at an extra cost of 30 units.

S(___ 4) = .975 reliability at an extra cost of 45 units—COST EXCEEDED

S(1111) = (cost of 90, reliability = .252)

S(1112) = (cost of 105, reliability = .378)

S(1113) = (cost of 120, reliability = .441)
S(1121) = (cost of 115, reliability = .3276)
S(1122) = (cost of 130, reliability = .4914)
S(1123) = (cost of 145---COST EXCEEDED)
S(2111) = (cost of 110, reliability = .27772)
S(2112) = (cost of 125, reliability = .4158)
S(2113) = (cost of 140---COST EXCEEDED)

The final maximum probability is .4914 at a cost of 130 and is given by S(1122).

TIME COMPLEXITY

WORST CASE

$T(n) = O(k^n)$

k = max.devices across stages