

---

# J Book

Jason Corderoy

## 1 Item Associations

1. d = data. Rows: baskets, columns: products, where 1=product in basket
2. pb = % baskets containing each product
3. ep = Expected % baskets containing each pair of products
4. ap = actual % baskets containing each pair of products
5. Calculate lift: ap/ep

```

nn=:4
]< d=:(,~nn)$ ?2#~ *~nn

|1 1 0 1|
|0 1 1 0|
|0 1 1 1|
|0 1 1 0|

]pb=:(+/% #)"2 d
0.25 1 0.75 0.5
]<ep=:(pb * =/~ i.nn) >. pb *"0 1 pb

|0.25 0.25 0.1875 0.125|
|0.25 1 0.75 0.5|
|0.1875 0.75 0.75 0.375|
|0.125 0.5 0.375 0.5|

]<ap=:>{(+/% #) */"1 y {"1 _1 d}} each { ;~ i.nn

|0.25 0.25 0 0.25|
|0.25 1 0.75 0.5|
|0 0.75 0.75 0.25|
|0.25 0.5 0.25 0.5|

]<lift=:ap%ep

|1 1 0 2|
|1 1 1 1|
|0 1 1 0.666667|
|2 1 0.666667 1|

```

## 2 Demand Fill Optimisation

1.  $x_o$  = Options
2.  $x_s$  = Random selection from options ( $x_o$ )
3.  $x_p$  = Problem to solve, which is the column sum of  $x_s$
4. Solve it. Solve knowing only  $x_p$  and  $x_o$ . Being blind to  $x_s$

Think of each column as a product and each row as an option for how much of each product. Thinking possible pallet configurations or possible cattle carcasse breakdowns makes these options more understandable.

```

nn=:4
]<xo=:8* (] % +/"1) (,~nn) $ ?2#~*~nn

2.66667 2.66667 0 2.66667|
      4      4 0      0|
      2      2 2      2|
      0      0 4      4|

]<x_s=:x_o {~ ?3#nn

2 2 2 2|
2 2 2 2|
2 2 2 2|

]x_p=:+/"2 x_s
6 6 6 6
xt=(x_o,0) {~ ?20#nn NB. rando solve incl all 0 option
eval=:3 : '+/ | x_p - +/"2 y'
bs=:3 : '({:xt) ,~ (x_o,0){~ (] i. <./) {{eval y, }: xt}}"1 x_o, 0'
NB. best solve
solver=: 3 : 0
xt=:bs 1
eval xt
)
solver"0 i.25
128 120 112 104 96 88 80 72 64 56 48 40 32 24 16 13.3333 8 4 4 0 0 0 0
0 0
]<x_t=:x_t {~ I. 0< +/"1 x_t

2 2 2 2|
0 0 4 4|
4 4 0 0|

```

### 3 Profit Optimisation

This is very similar to the demand fill optimisation example. Except with profit we want to maximise plus explicit weights are now needed. For example a product may have a gross profit of \$4 per unit when there is demand but may need to sell at a marked down price thereafter and may instead make a loss of \$1 per unit from that point on. It is weights like these that we are interested in when considering profit optimisation models.

Below we use a simple example. That us humans can quickly and easily solve. The approach below highlights the importance of this algorithm's ability to loop through previous solves to give it a chance to find a better solution to the problem after the first passthrough.

```

]<x0=(3 3) $ 2 0 0 1 1 0 1 0 1



|   |   |   |
|---|---|---|
| 2 | 0 | 0 |
| 1 | 1 | 0 |
| 1 | 0 | 1 |



]xp=:4 2 2
4 2 2
]<xt=(4,3) $ 0 NB. start with all zeros



|   |   |   |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |



]<wdf=:10 1 1 NB. demand fill weights



|    |   |   |
|----|---|---|
| 10 | 1 | 1 |
|----|---|---|



]<wde=:_10 _0.5 _0.5 NB. demand exceeded weights



|     |      |      |
|-----|------|------|
| _10 | _0.5 | _0.5 |
|-----|------|------|



eval=:3 : 0
csy=."/2 y
df=. xp <. csy
de=.0 >. csy-df
+/- (de*wde), (df*wdf)
)
NB. eval xt
bs=:3 : '({:xt) ,~ xo{~ (] i. >./) {{eval y, } : xt}}"1 xo' NB. best
solve finder
solver=: 3 : 0
xt=:bs 1
eval xt
)
NB. first try:
solver"0 i.4
20 40 31 22

```

<xt

1	1	0
1	1	0
2	0	0
2	0	0

xp - +/"2 xt

\_2 0 2

NB. second try:

solver"0 i.4

33 44 44 44

<xt

1	1	0
1	1	0
1	0	1
1	0	1

xp - +/"2 xt

0 0 0

