

Engines

It starts with an idea

When building a Netrunner deck we start with an idea of how to win the game. After having identified the cards which help us to do that we ask how we can pay for these cards and how we are going to get them in our hand in time. Since there are different choices we want to find the most suitable ones.

Engines for variables

In order to conquer the subject we divide the engine part of the deck into the engines of separate variables. With variables we mean the bits in pool, the cards in hand, the maximum handsize, the memory units, reusable bits and such. We are going to use the notion of engine in the sense that it does increase the variable which it is devised for while changing the other variables only minimally or not at all.

The claim is that this approach holds useful in not all but most cases.

Numerical characterization

We characterize the engine by the set of cards, the total number of these cards which is the engine's volume, the actions which a full cycle requires, the gain for the variable after one full cycle and the gain per action ratio. The important gain per action ratio generally increases with the number of full cycles and it is useful to see its increase with the number of turns.

Beyond the numbers

Like in a real engine also the components of a Netrunner deck have to fit together. Some combinations of engine parts might be synergetical whereas some plainly exclude one another. For example, a "tag me" strategy does not go well together with any Resource-based bit engine.

It can turn out quite useful to combine different engines for the same variable. For example a bit engine can consist of a part which produces bits at a low rate but needs little to no starting capital and a part which needs more starting capital but which has a much higher gain in the long run.

The overall goal is to balance the components with one another and also with the starting conditions of the game which are 5 bits, 5 cards, 5 handsize and 4 memory units.

Draw engines

Daniel Schneider has written an article about it which is called the "Theory of draw engines".

Bit engines for the runner

[It might be helpful to include a description for each engine as well but I did not have the time yet.]

Lemmings from Hell

Set: $3/2X$ Bodyweight Synthetic Blood, $5X$ Imps, X ValuPak Software Bundle, 1 misc for sale

Volume: $3/2X + 5X + 1X + 1 = 15/2X + 1$

Gain: $(5*3)X - 3X = 12X$

Actions: $5/2X + 1$

Gain/Action: $12X / (5/2X + 1) < 24/5 = 4,8$

Lemmings from Hell II

Set: $3X$ Jack'n'Joe, $5X$ Imps, X ValuPak Software Bundle, 1 misc for sale

Volume: $3X + 5X + 1X + 1 = 9X + 1$

Gain: $(5*3)X = 15X$

Actions: $4X + 1$

Gain/Action: $15X / (4X + 1) < 15/4 = 3,75$

Do the 'Drine and BSB

Set: 1 Do the 'Drine, X Bodyweight Synthetic Blood, X Militech MRAM Chip

Volume: $X + X + 1 = 2X + 1$

Gain: $(4*3)X - 2X - 2X = 8X$

Actions: $2X + 1$

Gain/Action: $8X / 2X + 1 < 4$
(2.7, 3.2, 3.4, 3.6, 3.6, 3.7, 3.7, 3.8, 3.8, 3.8)

Do the 'Drine and Jack'n'Joe

Set: 1 Do the 'Drine, X Jack'n'Joe, X MRAM Chip

Volume: $X + X + 1 = 2X + 1$

Gain: $(4*2)X = 8X$

Actions: $2X + 1$

Gain/Action: $8X / 2X + 1 < 4$
(2.7, 3.2, 3.4, 3.6, 3.6, 3.7, 3.7, 3.8, 3.8, 3.8)

Do the 'Drine and Jack'n'Joe

Set: 1 Do the 'Drine, 3X Jack'n'Joe , 2X Militech MRAM Chip

Volume: $3X + 2X + 1 = 5X + 1$

Gain: $(4*6)X - 4X = 20X$

Actions: $5X + 1$

Gain/Action: $20X / 5X + 1 < 4$

Set: 1 Do the 'Drine, 3X Bodyweight Synthetic Blood , 4X MRAM Chip

Volume: $3X + 4X + 1 = 7X + 1$

Gain: $(4*8)X - 6X - 4X = 22X$

Actions: $7X + 1$

Gain/Action: $22X / 7X + 1 < 22/7 = 3,14$

Panzer Run and Networking

Set: X PR, X NW

Volume: $2X$

Gain: $9X$

Actions: $4X$

Gain/Action: $9/4 = 2,25$

Panzer Run, Networking, Elena Laskova

Set: X PR, X NW, 1 EL

Volume: $2X + 1$

Gain: $11X - 3$

Actions: $4X + 1$

Gain/Action: $(11X - 3)/(4X + 1) = 11/4 - 23/(16X+4) < 11/4 = 2,75$

Panzer Run, Networking, Elena Laskova, Zetatech Portastation

Set: X PR, X NW, Y (max.4) ZPS, 1 EL

Volume: $2X + Y + 1$

$$\text{Gain: } 11X + Y \cdot X - 3Y - 3$$

$$\text{Actions: } 4X + Y + 1$$

$$\text{Gain/Action: } (11X + Y \cdot X - 3Y - 3)/(4X + Y + 1) = 11/4 + Y/4 - (Y^2 + 24Y - 23)/4(4X + Y + 1) < 11 + Y/4 \leq 15/4 = 3,75$$

Panzer Run, Score!, Elena Laskova, Zetatech Portastation

Set: A) X+Y+1 PR, X Score!, Y (max. 20) ZPS, 1 EL
B) X+Y+1 PR, X Score!, Y (max. 11) ZPS, 1 EL

Different plans: A) 2 PR, 2 PR, 4 Score! OR B) 2PR, 1 PR + 2 Score!, 1 PR + 2 Score!

$$\text{Volume: } 2(X + Y + 1)$$

Gain: $7X - 3Y + 3Y - 3 + A) Y=1: 3/4 X, Y=2: 6/4 X, Y=3: 7/4 X, Y=4: 8/4X, \dots, Y=20: 24/4X$ |
asymptotic: $(Y+4) \cdot X/4$

B) $Y=1: 3/4 X, Y=2: 6/4 X, Y=3: 8/4 X, Y=4: 10/4X, \dots, Y=11: 24/4X$
asymptotic: $2(Y+1) \cdot X/4 = (Y+1) \cdot X/2$

---> plan A) is superior in any case

$$\text{Superior Gain: } 7X + (Y+1) \cdot X/2 - 3$$

$$\text{Actions: } 2(X+Y+1) + (X + Y + 1) = 3(X + Y + 1)$$

$$\text{Gain/Action: } (7X + (Y+1) \cdot X/2)/3(X + Y + 1) = 7/3 + (Y+1)/6 - 1/6 (Y^2 + 16Y + 15)/(X+Y+1) = 15/6 + Y/6 - 1/6 \cdot (Y^2 + 16Y + 15)/(X+Y+1) < 26/6 \sim 4,33$$

Drone for a day and BSB engine:

Set: X BSB, 4 X DFAD

$$\text{Volume: } 5 X$$

$$\text{Gain: } 20X - 2X = 18X$$

$$\text{Actions: } 5X$$

$$\text{Gain/Action: } 18/5 = 3,6$$

Score! and BSB engine:

Set: X BSB, 4 X Score!

$$\text{Volume: } 5 X$$

$$\text{Gain: } 16X - 2X = 14X$$

$$\text{Actions: } 5X$$

$$\text{Gain/Action: } 14/5 = 2,8$$

Livewire's Contacts and BSB engine:

Set: X BSB, 4 X LC

Volume: 5 X

Gain: $12X - 2X = 10X$

Actions: 5X

Gain/Action: $10/5 = 2$

Drone for a day and JNJ engine:

Set: X JNJ, 2X DFAD

Volume: 3X

Gain: 10X

Actions: 3X

Gain/Action: $10/3 = 3,33$

Score! and JNJ engine:

Set: X JNJ, 2X Score!

Volume: 3X

Gain: 8X

Actions: 3X

Gain/Action: $8/3 = 2,66$

Livewire's Contacts and JNJ engine:

Set: X BSB, 2X LC

Volume: 3X

Gain: 6X

Actions: 3X

Gain/Action: $6/3 = 2$

Lucidrine BD, BSB, Liberated Savings Account

Set: X LBD, 3/4 X BSB, 2X LSA

Volume: 15/4 X

$$\text{Gain: } 17 X - 3/2 X = 31/2 X$$

$$\text{Actions: } 15/4 X$$

$$\text{Gain/Action: } (31/2)/(15/4) = 124/30 = 4,13$$

Lucidrine BD, BSB, Liberated Savings Account, Militech MRAM Chip

$$\text{Set: } X \text{ LBD, } 3/4 X \text{ BSB, } 2X \text{ LSA, } X/3 \text{ MMRAM}$$

$$\text{Volume: } 49/12 X$$

$$\text{Gain: } 17 X - 3/2 X - 2/3 X = 89/6 X$$

$$\text{Actions: } 49/12 X$$

$$\text{Gain/Action: } (89/6)/(49/12) = 3,63$$

Lucidrine BD, BSB, Liberated Savings Account, MRAM Chip

$$\text{Set: } X \text{ LBD, } 3/4 X \text{ BSB, } 2X \text{ LSA, } X/2 \text{ MMRAM}$$

$$\text{Volume: } 17/4 X$$

$$\text{Gain: } 17 X - 3/2 X - 1/2 X = 15 X$$

$$\text{Actions: } 17/4 X$$

$$\text{Gain/Action: } (15)/(17/4) = 60/17 = 3,53$$

Lucidrine BD, JNJ, Liberated Savings Account

$$\text{Set: } X \text{ LBD, } 3/2 X \text{ JNJ, } 2X \text{ LSA}$$

$$\text{Volume: } 9/2 X$$

$$\text{Gain: } 17 X$$

$$\text{Actions: } 9/2 X$$

$$\text{Gain/Action: } (17)/(9/2) = 34/9 = 3,77$$

Lucidrine BD, JNJ, Liberated Savings Account, MRAM Chip

$$\text{Set: } X \text{ LBD, } 3/2 X \text{ JNJ, } 2X \text{ LSA, } X/2 \text{ MRAM Chip}$$

$$\text{Volume: } 5 X$$

$$\text{Gain: } 17 X - X/2 = 33/2 X$$

$$\text{Actions: } 5X$$

$$\text{Gain/Action: } (33/2)/(5) = 33/10 = 3,30$$

Lucidrine BD, JNJ, Liberated Savings Account, Militech MRAM Chip

Set: X LBD, 3/2 X JNJ, 2X LSA, X/3 MMRAM

Volume: 29/6 X

Gain: 17 X - 2/3 X = 48/3 X

Actions: 29/6 X

Gain/Action: (48/3)/(29/6) = 3,31

Organ Donor plus only BSB

Set: X Organ Donor, 3/2 X BSB + 5X various organs :)

Volume: 15/2 X

Gain: 10X - 3/2 *2 X = 7 X

Actions: 5/2X

Gain/Action: 14/5 = 2,8

Set: 3X Edited Shipping Manifest (break cost Y), X Total Genetic Retrofit, X Bodyweight Synthetic Blood

Volume: 5X

Gain: 3X*10 - 3X - 3X - 2X - 3X*Y = 22X - 3XY

Actions: 5X

Gain/Action: (22X - 3XY) / 5X = 4,4 - 0.6 Y

Set: 2X Edited Shipping Manifest (break cost Y), X Remote Detonator, X Total Genetic Retrofit, X Bodyweight Synthetic Blood

Volume: 5X

Gain: 2X*10 - 2X - 7X - 3X - 2X - X*Y = 6X - XY

Actions: 5X

Gain/Action: (6X - XY) / 5X = 5/6 - 0.2 Y

Set: 1 Broker (use X times), 1 Cruising for Netwatch

Volume: 2

Gain: 3*X-3+1 = 3X - 2

Actions: X+3

Gain/Action: $3X-2/(X+3) < 3$
(0.25, 0.8, 1.17, 1.49, 1.6, 1.8, 1.9, 2, 2.1, 2.2)

Set: 1 Broker (use X times), [1 Draw]

Volume: 1

Gain: $3*X-3 = 3(X - 1)$

Actions: $X+3$

Gain/Action: $3(X-1)/(X+3) < 3$
(0, 0.6, 1, 1.3, 1.5, 1.7, 1.8, 1.9, 2, 2.1)

Set: 1 Newsgroup Filter (use X times), 1 Cruising for Netwatch

Volume: 2

Gain: $2X-5+1 = 2(X-2)$

Actions: $X+2$

Gain/Action: $2(X-2)/(X+2) < 2$
(-0.7, 0, 0.4, 0.7, 0.9, 1, 1.1, 1.2, 1.3, 1.33)

Set: 3X Lucidrine BD, 6X Liberated Savings Account, X Militech MRAM Chip, 1 Lifesaver Nanosurgeons (use 5X times),

Volume: $3X + 6X + X + 1 = 10X + 1$

Gain: $9*3X + 4*6X - 2X - 1 = 40X - 1$

Actions: $10X + 1 + 5X = 15X + 1$

Gain/Action: $(40X - 1) / (15X + 1) < 8/3 = 2.66$
(2.44, 2.55, 2.59, 2.61, 2.62, 2.63, 2.63, 2.64, 2.64, 2.64)

Set: 1 Smith's Pawnshop, 1 Crash Everett, X Bodyweight Synthetic Blood, X Militech MRAM Chip, 1 Omnitech Spinal Tap Cybermodem, 1 Do the Drine, 1 Arasaka Owns You, 6X Score!

Volume: $2X + 5 + 6X = 8X + 5$

Gain: $12X - 2X - 2X - 2 - 5 + 10 + 4*3X = 20X + 3$

Actions: $2X + 5 + 4 + 3X = 5X + 9$

Gain/Action: $(20X + 3) / (5X + 9) < 20/5 = 4$

Set: 1 Smith's Pawnshop, 1 Crash Everett, X Bodyweight Synthetic Blood, X Militech MRAM Chip, 1 Omnitech Spinal Tap Cybermodem, 1 Do the Drine, 1 Arasaka Owns You, 3X Lucidrine BD, 3X [blank card]

Volume: $2X + 5 + 6X = 8X + 5$

$$\text{Gain: } 12X - 2X - 2X - 2 - 5 + 10 + 9 \cdot \frac{1}{2} \cdot 3X = 43/2 \cdot X + 3$$

$$\text{Actions: } 2X + 5 + 4 + 1/2 \cdot 3X = 7/2 \cdot X + 9$$

$$\text{Gain/Action: } (43/2X + 3) / (7/2X + 9) < 43/7 = 6.14$$

Set: 1 Smith's Pawnshop, 1 Crash Everett, X Bodyweight Synthetic Blood, X Militech MRAM Chip, 1 Omnitech Spinal Tap Cybermodem, 2 Do the Drine, 1 Arasaka Owns You, 6X-1 [blank card]

$$\text{Volume: } 2X + 6 + 6X - 1 = 8X + 5$$

$$\text{Gain: } 12X - 2X - 2X - 2 - 5 + 10 + 4 \cdot 3X = 20X + 3$$

$$\text{Actions: } 2X + 5 + 4 + 1 = 2X + 10$$

$$\text{Gain/Action: } (20X + 3) / (2X + 10) < 10$$

(1.9, 3.1, 3.9, 4.6, 5.2, 5.6, 6.0, 6.3, 6.5, 6.8)

Set: 1 Smith's Pawnshop, 1 Crash Everett, 3X Jack'n'Joe, 2X MRAM Chip, 1 Omnitech Spinal Tap Cybermodem, 2 Do the Drine, 1 Arasaka Owns You, 6X-1 [blank card]

$$\text{Volume: } 11X + 5$$

$$\text{Gain: } 4 \cdot 2X - 2X - 2 - 5 + 10 + 4 \cdot (2X - 1) = 14X - 1$$

$$\text{Actions: } 5X + 6$$

$$\text{Gain/Action: } (14X - 1) / (5X + 6) < 14/5 = 2.8$$

(1.8, 2.9, 3.75, 4.4, 4.9, 5.3, 5.7, 6.0, 6.2, 6.4)

Set: 16X Top Runner's Conference (Y turns), 4X Bodyweight Synthetic Blood (4 TRC, 1 BSB 3 TRC, 1 BSB, 3 TRC, 1 BSB 3 TRC, 1 BSB 3 TRC, repeat)

$$\text{Volume: } 20X$$

$$\text{Gain: } 2 \cdot (4Y + 3(Y-1) + 3(Y-2) + 3(Y-3) + 3(Y-4)) \cdot X - 2 \cdot 4X = (32Y - 68)X$$

$$\text{Actions: } \text{Max}[4Y, 20X]$$

$$\text{Gain/Action: } (32Y - 68)X / (4Y + 20X)$$

Set: 8X Top Runner's Conference (Y turns), 4X Jack'n'Joe (4TRC, 2 JNJ 2 TRC, 2 JNJ 2 TRC, repeat)

$$\text{Volume: } 12X$$

$$\text{Gain: } 2 \cdot (4Y + 2(Y-1) + 2(Y-2)) \cdot X = (16Y - 12)X$$

$$\text{Actions: } \text{Max}[4Y, 12X]$$

$$\text{Gain/Action: } (16 \cdot Y - 12)X / (12X) = 4/3 Y - 1$$

Analysis

The gain is a function of the form $aX+b$. The actions are a function of form $cX+d$. The parameters do not need to be constant as we see from some engines.

Gain per action ratio is then $G/A=(aX+b) / (cX+d)$. We can express X in terms of A or in terms of the number $T=A/4$ of turns: $X=(4T - d) / c$. Putting this into G/A yields: $G/A = a/c - ((a/c)*d - b) / 4T$. For high T this ratio G/A will reach the “saturation value” $s=a/c$. I put this in quotation marks since it does not really need to be a constant.

$$G/A (T) = s - (s*d - b) / 4T$$

$s*d - b$ is the quantity which governs how fast the saturation is reached. If that difference is small it happens fast; if it is big it happens slowly.

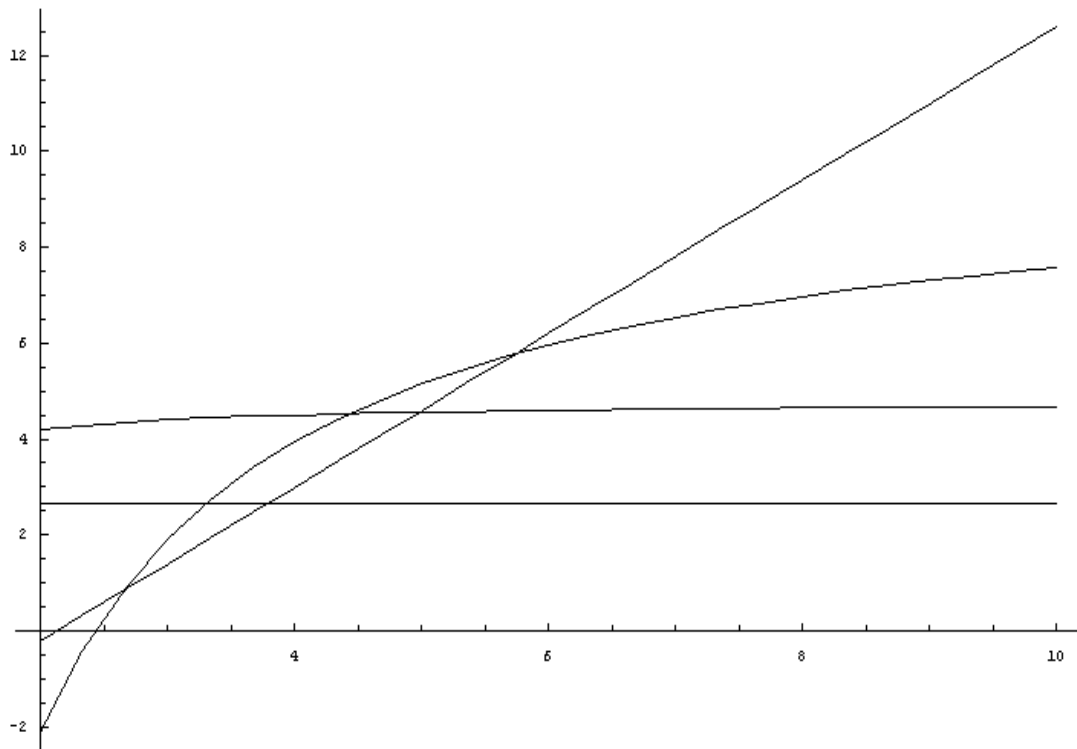


Figure1: Plot of the examples Lemmings from Hell ($a=12$, $b=0$, $c=2.5$, $d=1$, $s=4.8$), Score! plus JNJ ($a=8$, $b=0$, $c=3$, $d=0$, $s=2.7$), one engine with Top Runner's Conference ($a=32T - 68$, $b=0$, $c=20$, $d=0$, straight line) and one engine with Arasaka Owns You ($a=20$, $b=3$, $c=2$, $d=10$, $s=10$).

Some preliminary conclusions

Clearly, there are differences between the bit engines. We have to keep in mind what the expected time scale of our used format is. If we cannot spend more than 5 full turns (or 20 actions) for the engine the situation has to be looked at more carefully. Otherwise it might be worth to include a bit engine with a high saturation value at least in parts.

Bit engines for the corporation

Set: X Accounts Receivable, X Day Shift

Volume: 2X

Gain: $4X+X=5X$

Actions: 2X

Gain/Action: $5X/2X = 2.5$

Set: X Accounts Receivable, 1 ESA Contract

Volume: X+1

Gain: 4X

Actions: $X+X/2+1 = 3X/2+1$

Gain/Action: $4X/(3X/2+1)=8X/(3X+2) < 8/3 = 2.7$

(1.6, 2, 2.18, 2.29, 2.35, 2.4, 2.43, 2.46, 2.48, 2.5)

Set: 3X Accounts Receivable, X Corporate Shuffle

Volume: 4X

Gain: 12 X

Actions: $3X + 2X = 5X$

Gain/Action: $12/5 = 2.4$

Set: 2X Accounts Receivable, X Annual Reviews

Volume: 3X

Gain: 8X

Actions: 3X

Gain/Action: $8/3 = 2.7$

Set: 1 South African Mining Corporation

Volume: 1

Gain: 6X

Actions: 3X+1

Gain/Action: $6X/(3X+1) < 2$

(1.5, 1.71, 1.8, 1.84, 1.88, 1.89, 1.91)

Set: 1 Department of Truth Enhancement, 1 Day Shift

Volume: 1

Gain: $3X - 2$

Actions: $X + 1$

Gain/Action: $3X / (X + 1) < 3$

(0.5, 1.33, 1.75, 2, 2.17, 2.29, 2.38, 2.44, 2.5, 2.54, 2.58, 2.62)

Set: X Holoovid Campaign, X Day Shift

Volume: $2X$

Gain: $9X$

Actions: $2X$

Gain/Action: $9X / 2X = 4.5$

Set: 1 Braindance Campaign, 1 Day Shift

Volume: 2

Gain: 7

Actions: 2

Gain/Action: 3.5

Set: X Rockerboy Promotion, X Day Shift

Volume: $2X$

Gain: $11X + 1X = 12X$

Actions: $7X$

Gain/Action: $12X / 7X = 1.71$

Set: 1 ESA Contract, 1 Syd Meyer Superstores, X Edgerunner, Inc. Temps, 3X Misleading Access Menus

Volume: $4X + 2$

Gain: $7*3X - X = 20X$

Actions: $2X + X + 3X + 2 = 6X + 2$

Gain/Action: $20X / (6X + 2) < 10/3 = 3,33$

Set: X BBS Whispering Campaign, X Day Shift

Volume: 2 X

Gain: $16X + 1X = 17X$

Actions: 9X

Gain/Action: $17X / 9X = 1.89$

Set: 2X Holoovid Campaign, X Annual Reviews

Volume: 3X

Gain: 16X

Actions: 3X

Gain/Action: $16X / 3X = 5.33$

Set: 2X Braindance Campaign, X Annual Reviews

Volume: 3X

Gain: 12X

Actions: 3X

Gain/Action: 4

Set: 2X Rockerboy Promotion, X Annual Reviews

Volume: 3X

Gain: 22X

Actions: $12X + X = 13X$

Gain/Action: $22/13 = 1.69$

Set: 2X BBS Whispering Campaign, X Annual Reviews

Volume: 3X

Gain: 32X

Actions: $16X + X = 17X$

Gain/Action: $32/17 = 1.88$

Set: 3X Investment Firm, 1 LDL Traffic Analyzers, 1 Blood Cat, 1 Chicago Branch (usage Y times), X+1 Edgerunner Inc. Temps, 2X + 2 Annual Reviews

Volume: $6X + 6$

Gain: $-3X - (X + 1) - 6 - 2 - 3Y + 60*Y*X = Y*(60X - 3) - 4X - 9 = (60Y - 4) X - 3Y - 9$

Actions: $2X + 2 + X + 1 + Y + 1 = 3X + Y + 4$

Gain/Action: $(Y * (60X - 3) - 4X - 9) / (3X + Y + 4) = \dots$

[X=1,Y=2]: ... = 0.125

[X=1,Y=4]: ... = 1.5

[X=1,Y=5]: ... = 2

[X=1,Y=10]: ... = 3.56

[X=2,Y=2]: ... = 1.5

[X=2,Y=4]: ... = 3.9

[X=2,Y=5]: ... = 4.86

[X=3,Y=3]: ... = 4

[X=3,Y=5]: ... = 6.7

[X=4,Y=2]: ... = 2.88

[X=4,Y=4]: ... = 6.47

Set: 3X Investment Firm, X Edgerunner Inc. Temps, $4X/3 + 1$ Corporate Shuffle, 1 Data Fort Reclamation, 1 Management Shake-Up

Volume: $3X + X + 4X/3 + 1 + 2 = 16X/3 + 3$

Gain: $3X*20 - 3X - X - 10 = 56X - 10$

Actions: $X + 4X/3 + 1 + 1 + 1 = 7X/3 + 3$

Gain/Action: $(56X - 10) / (7X/3 + 3) = 24 - 246/(7X+9) < 24$

(8.6, 13.3, 15.8, 17.4, 18.4, 19.2, 19.8, 20.2)

Set: X Management Shake-Up , X Corporate War

Volume: $2X$

Gain: $12X - 10X = 2X$

Actions: $4 X$

Gain/Action: 0.5

Set: X Edgerunner Inc. Temps, 3X Investment Firm

Volume: $4X$

Gain: $6*X*Y - X - 3X = 2*X*Y - 4X$

Actions: $X + 4X + Y = 5X + Y$

Gain/Action: $(6 * X * Y - 4X) / (Y + 5X) =$

[X=1, Y= 5]: ... = 2.6

[X=1, Y= 9]: ... = 3.6

[X=4, Y= 5]: ... = 4.2

[X=4, Y=10]: ... = 7.5

Set: X Edgerunner Inc. Temps, 3X Investment Firm (charge using Y actions), 2X Annual Reviews

Volume: 6X

Gain: $6 * X * Y - 4X$

Actions: $X + 2X + Y = 3X + Y$

Gain/Action: $(6 * X * Y - 4X) / (Y + 3X) =$

[X=1, Y= 2]: ... = 1.6

[X=1, Y= 8]: ... = 4

[X=4, Y= 4]: ... = 1

[X=4, Y= 4]: ... = 5

[X=4, Y= 7]: ... = 8

Set: X Edgerunner Inc. Temps, 3X Investment Firm, Y Efficiency Experts, $(4X+Y)/2$ Annual Reviews

Volume: $(4X+Y) * 3/2$

Gain: $18 * X * Y - X - 3X = 18XY - 4X$

Actions: $X + Y + (4X+Y)/2 = 3X + 3Y/2$

Gain/Action: $(18XY - 4X)/(3X + 3Y/2) = (12XY - 8X/3)/(2X+Y) = ...$

[X=1, Y=1]: ... = 3.1

[X=1, Y=5]: ... = 8.2

[X=4, Y=1]: ... = 4.1

[X=4, Y=5]: ... = 17.6

Analysis

See for runner, instead of four actions we have three actions for one turn now. The card at start of turn can be seen as part of the draw engine according to our definition.

For cards like Investment Firm the function in terms of turns has to be written differently.