spreadsheets

@JennyBryan

@jennybc

STAT 545

@STAT545

http://stat545.com

relevant links, credits, and slides:

https://github.com/jennybc/2016-06_spreadsheets

Rich FitzJohn

Research Software Engineer
University College London

@rgfitzjohn

@richfitz

spreadsheets:
a dystopian moonscape
of unrecorded
user actions

— Gordon Shotwell

some of my best friends use spreadsheets

~1 billion use Microsoft Office

~650 million use spreadsheets

>50% use formulas

1 - 5 million people use Python

250K - 1 million people use R

you go into data analysis with the tools you know, not the tools you need

spreadsheets combine:

- data
- logic
- figures
- formatted tables

+ reactivity

spreadsheet users

use workbooks

like I would use

a data analytic git repo

a data analytic project:

- data
  - .R, .Rmd
  - .png, .svg
  - .md, .html, .pdf, Shiny app

+ build and deploy

Jenny Bryan @JennyBryan · Apr 20

I'm seeking TRUE, crazy spreadsheet stories. Happy to get the actual sheet or just a description of the crazy. Also: I can keep a secret.

Based on surveys made by members of the Staff of Indiana University and supported by the National Research Council with Rockefeller Foundation funds

SEXUAL BEHAVIOR IN THE HUMAN MALE

ALFRED C. KINSEY
WARDELL B. POMEROY
CLYDE E. MARTIN

Based on surveys made by members of the Staff of Indiana University and supported by the National Research Council with Rockefeller Foundation funds

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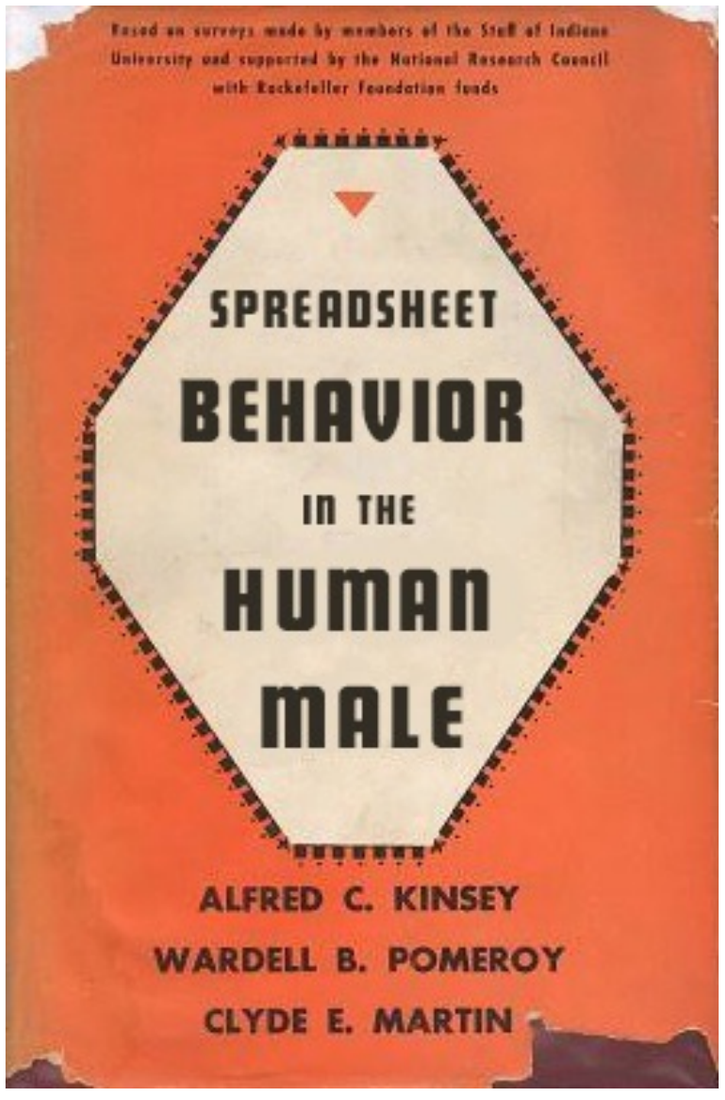


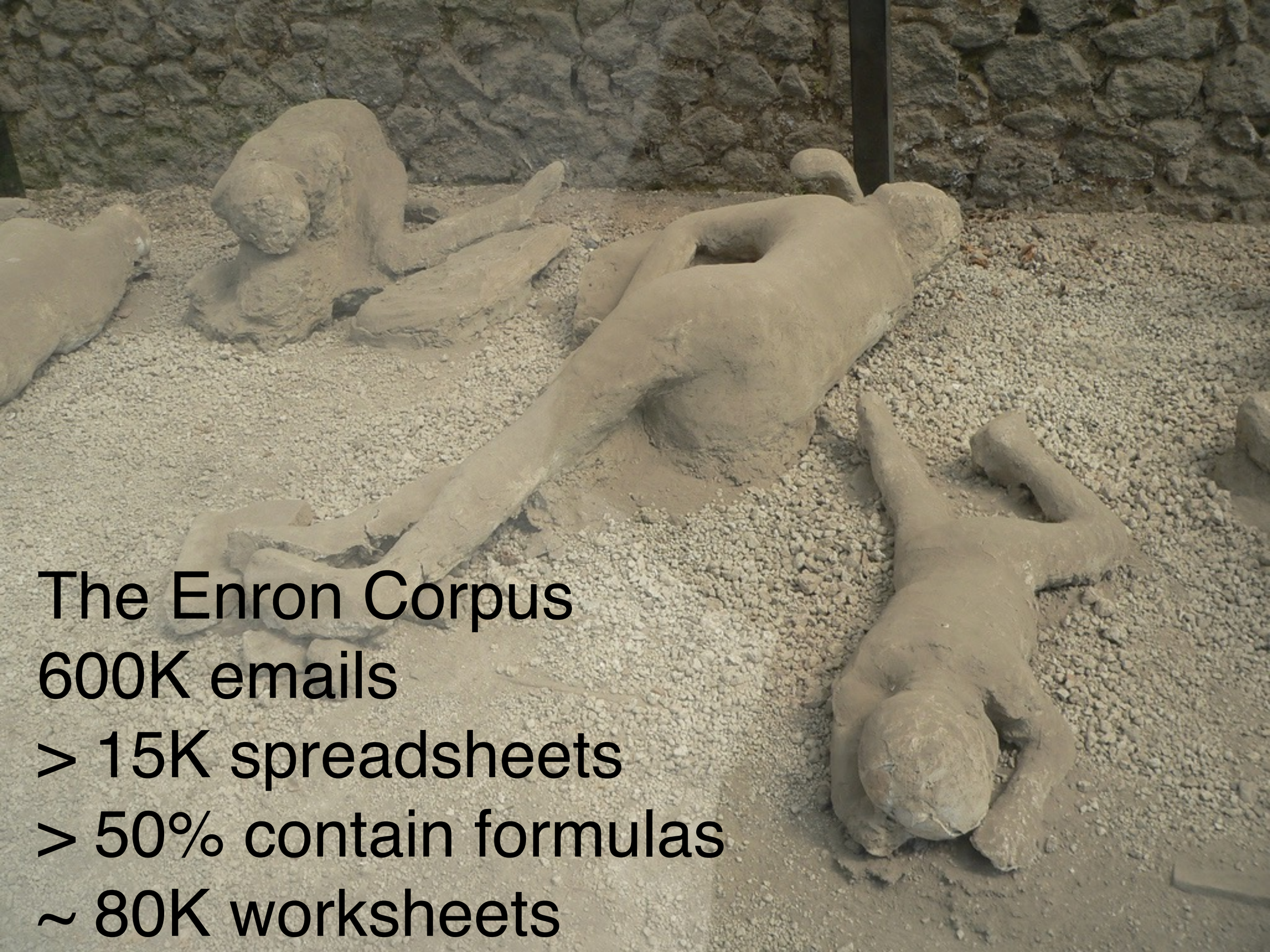
what you THINK people are doing

!=

what you think people SHOULD be doing

!=

what people ARE ACTUALLY doing



The Enron Corpus
600K emails
> 15K spreadsheets
> 50% contain formulas
~ 80K worksheets

Enron North America - West Gas

November 9, 2001

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Forward Prices (US$/MMBtu)

	NYMEX	
	SETTLE	Δ
Cash		
ROM		
Dec-01	2.960	0.090
Dec-01 to Mar-02	3.088	0.083
Apr-02 to Oct-02	3.166	0.084
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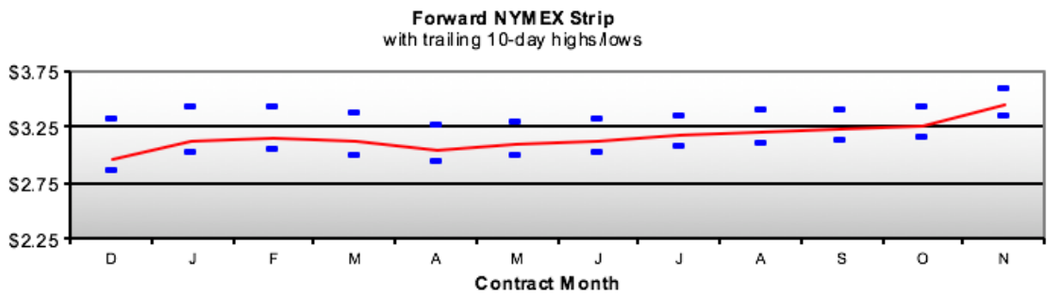

IF NWPL Rocky Mountains			
Fixed Price		Basis	
BID	OFFER	BID	OFFER
1.890	1.910		
2.060	2.080		
2.395	2.415	(0.565)	(0.545)
2.594	2.614	(0.494)	(0.474)
2.581	2.601	(0.585)	(0.565)
3.356	3.376	(0.295)	(0.275)
2.634	2.654	(0.530)	(0.510)

IF CIG Rocky Mountains				
	Fixed Price		Basis	
	BID	OFFER	BID	OFFER
Cash	1.940	1.960		
ROM	1.960	1.980		
Dec-01	2.345	2.365	(0.615)	(0.595)
Dec-01 to Mar-02	2.548	2.568	(0.540)	(0.520)
Apr-02 to Oct-02	2.471	2.491	(0.695)	(0.675)
Nov-02 to Mar-03	3.311	3.331	(0.340)	(0.320)
One Year Strip*	2.551	2.571	(0.614)	(0.594)

IF EL Paso Permian				
	Fixed Price		Basis	
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Cash	2.375	2.395		
ROM	2.420	2.440		
Dec-01	2.700	2.720	(0.260)	(0.240)
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ROM	2.530	2.550		
Dec-01	2.828	2.848	(0.133)	(0.113)
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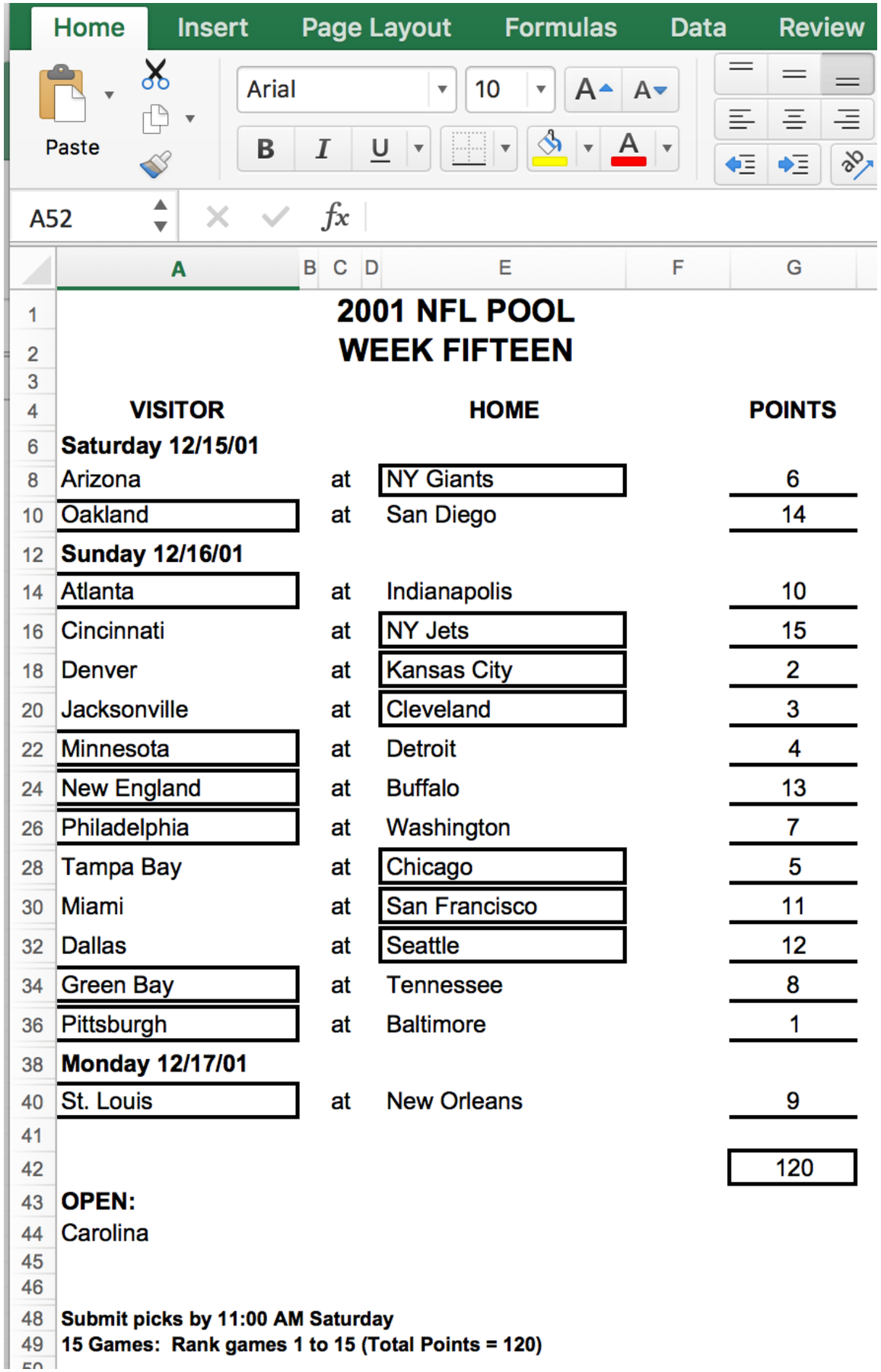


Home | Insert | Page Layout | Formulas | Data | Review

Paste | Arial | 10 | A52

	A	B	C	D	E	F	G
1	**2001 NFL POOL**						
2	**WEEK FIFTEEN**						
3							
4	**VISITOR**				**HOME**		**POINTS**
6	**Saturday 12/15/01**						
8	Arizona		at		NY Giants		6
10	Oakland		at		San Diego		14
12	**Sunday 12/16/01**						
14	Atlanta		at		Indianapolis		10
16	Cincinnati		at		NY Jets		15
18	Denver		at		Kansas City		2
20	Jacksonville		at		Cleveland		3
22	Minnesota		at		Detroit		4
24	New England		at		Buffalo		13
26	Philadelphia		at		Washington		7
28	Tampa Bay		at		Chicago		5
30	Miami		at		San Francisco		11
32	Dallas		at		Seattle		12
34	Green Bay		at		Tennessee		8
36	Pittsburgh		at		Baltimore		1
38	**Monday 12/17/01**						
40	St. Louis		at		New Orleans		9
41							
42							120
43	**OPEN:**						
44	Carolina						
45							
46							
48	**Submit picks by 11:00 AM Saturday**						
49	**15 Games: Rank games 1 to 15 (Total Points = 120)**						

data in formatting

Plot: 2			
Date collecte	Species	Sex	Weight
1/8/14	NA		
1/8/14	DM	M	44
1/8/14	DM	M	38
1/8/14	OL		
1/8/14	PE	M	22
1/8/14	DM	M	38
1/8/14	DM	M	48
1/8/14	DM	M	43
1/8/14	DM	F	35
1/8/14	DM	M	43
1/8/14	DM	F	37
1/8/14	PF	F	7
1/8/14	DM	M	45
1/8/14	OT		
1/8/14	DS	M	157
1/8/14	OX		
2/18/14	NA	M	218
2/18/14	PF	F	7
2/18/14	DM	M	52
	measurement device not calibrated		

	A	B	C
1	species	tail length	
2	Allactaga balikunica	**177.32**	
3	Allactaga bullata	165.2	
4	Allocricetulus eversmanni	**18.64**	
5	Apodemus uralensis	84.89	
6	Arvicola amphibius	105.14	
7	Brachytarsomys albicauda	230.02	
8	Brachyuromys betsileoensis	83.32	
9	Cardiocranius paradoxus	**74.36**	
10	Castor fiber	379.89	
11	Cricetulus barabensis	24.72	
12			
13	**bold = needs checking**		
14	yellow = from different source		
15			

small multiples

data in formulas

Excel File Edit View Insert Format Tools Data Window Help

snaildata

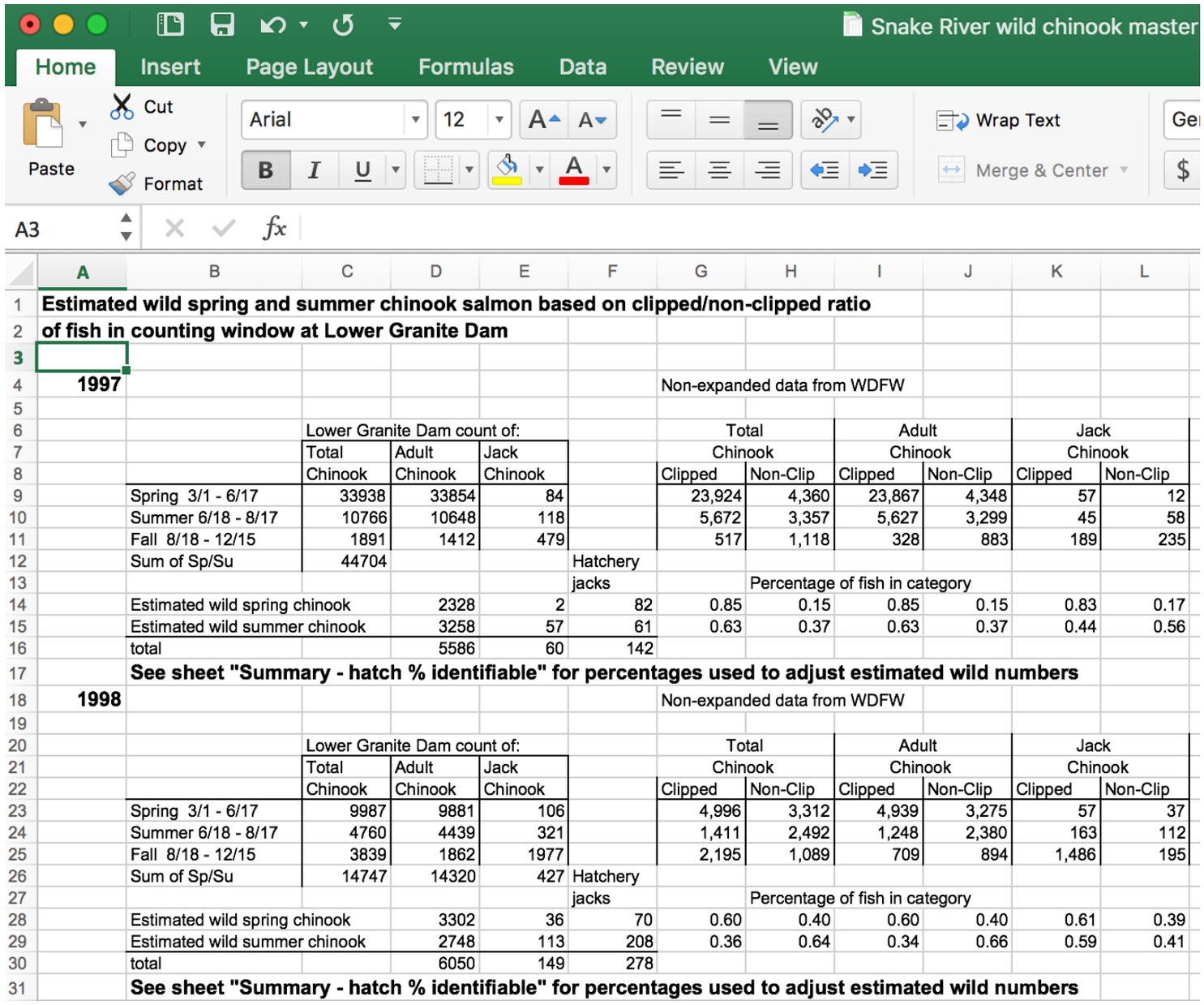
Home Insert Page Layout Formulas Data Review View

C5 =(3.6946*10^-6)/'Old snails'!J26

	A	B	C	D	E	F	G	H	I
1	oldsnail27_	peak force (kN/m^2)		developed force (kN/n		time to pf (ms)		time to relax (ms)	
2	Time (min)	Control	AAPH	Control	AAPH	Control	AAPH	Control	AAPH
3	0	15.50528	N/A	15.34497	N/A	362	N/A	251	N/A
4	5	15.79448	11.6517	12.52871	10.25405	346	335	244	278
5	8	15.15288	13.33965	12.02323	11.77049	343	349	239	278
6	12	14.46832	14.76727	10.72342	11.30112	358	353	280	298
7	18	12.05681	15.77029	8.95424	11.33722	337	371	313	317
8	24	11.5714	16.32993	6.679	11.69828	334.4244	369	324.122	317
9	40	8.429	16.33932	1.239	12.02323	319.074	413	385.13	336
10	50	6.465	15.78004	-2.161	13.97295	309.48	429	423.26	349

=(3.6946*10^-6)/'Old snails'!J26

data in (merged) column headers



Snake River wild chinook master

Home | Insert | Page Layout | Formulas | Data | Review | View

Paste | Cut | Copy | Format | Arial | 12 | Wrap Text | Merge & Center

A3

	A	B	C	D	E	F	G	H	I	J	K	L
1	**Estimated wild spring and summer chinook salmon based on clipped/non-clipped ratio**											
2	**of fish in counting window at Lower Granite Dam**											
3												
4	**1997**						Non-expanded data from WDFW					
5												
6			Lower Granite Dam count of:				Total Chinook		Adult Chinook		Jack Chinook	
7			Total Chinook	Adult Chinook	Jack Chinook		Clipped	Non-Clip	Clipped	Non-Clip	Clipped	Non-Clip
9		Spring 3/1 - 6/17	33938	33854	84		23,924	4,360	23,867	4,348	57	12
10		Summer 6/18 - 8/17	10766	10648	118		5,672	3,357	5,627	3,299	45	58
11		Fall 8/18 - 12/15	1891	1412	479		517	1,118	328	883	189	235
12		Sum of Sp/Su	44704			Hatchery						
13						jacks		Percentage of fish in category				
14		Estimated wild spring chinook		2328	2	82	0.85	0.15	0.85	0.15	0.83	0.17
15		Estimated wild summer chinook		3258	57	61	0.63	0.37	0.63	0.37	0.44	0.56
16		total		5586	60	142						
17		**See sheet "Summary - hatch % identifiable" for percentages used to adjust estimated wild numbers**										
18	**1998**						Non-expanded data from WDFW					
19												
20			Lower Granite Dam count of:				Total Chinook		Adult Chinook		Jack Chinook	
21			Total Chinook	Adult Chinook	Jack Chinook		Clipped	Non-Clip	Clipped	Non-Clip	Clipped	Non-Clip
23		Spring 3/1 - 6/17	9987	9881	106		4,996	3,312	4,939	3,275	57	37
24		Summer 6/18 - 8/17	4760	4439	321		1,411	2,492	1,248	2,380	163	112
25		Fall 8/18 - 12/15	3839	1862	1977		2,195	1,089	709	894	1,486	195
26		Sum of Sp/Su	14747	14320	427	Hatchery						
27						jacks		Percentage of fish in category				
28		Estimated wild spring chinook		3302	36	70	0.60	0.40	0.60	0.40	0.61	0.39
29		Estimated wild summer chinook		2748	113	208	0.36	0.64	0.34	0.66	0.59	0.41
30		total		6050	149	278						
31		**See sheet "Summary - hatch % identifiable" for percentages used to adjust estimated wild numbers**										

	A	B	C
1	name	mass	threat status
2	Rodentia		
3	rat	56	LC
4	mouse	90	LC
5	squirrel	24	CR
6	Primates		
7	gibbon	7000	LC
8	bushbaby	678	EN
9	Chiroptera		
10	myotis	45	NT
11	smaller myotis	48	NT
12	fishing bat	89	VU
13	bulldog bat	33	DD

readxl: CRAN, GitHub
openxlsx: CRAN, GitHub

XLConnect: CRAN, GitHub
xlsx: CRAN, GitHub

gdata: CRAN, R-Forge
… and more

What do we want?

no Java
agnostic re: Excel, Google Sheet, ill-formed csv

expose
- (unformatted) data
- (unevaluated) formulas
- formatting

detect / propose views
handle merged cells, weird headers

How are we doing it?

define the **linen** object = spreadsheet receptacle
  meta-data on the document
  meta-data on the worksheets
  cell data, broadly defined

rexcel & googlesheets read into linen objects
  simple? return a data frame!
  not? expose linen object for more processing …

Sheets API v3
(XML)

Google Apps
Script / Sheets
API v4 (JSON)

(XML)

linen

workbook
worksheets
cells

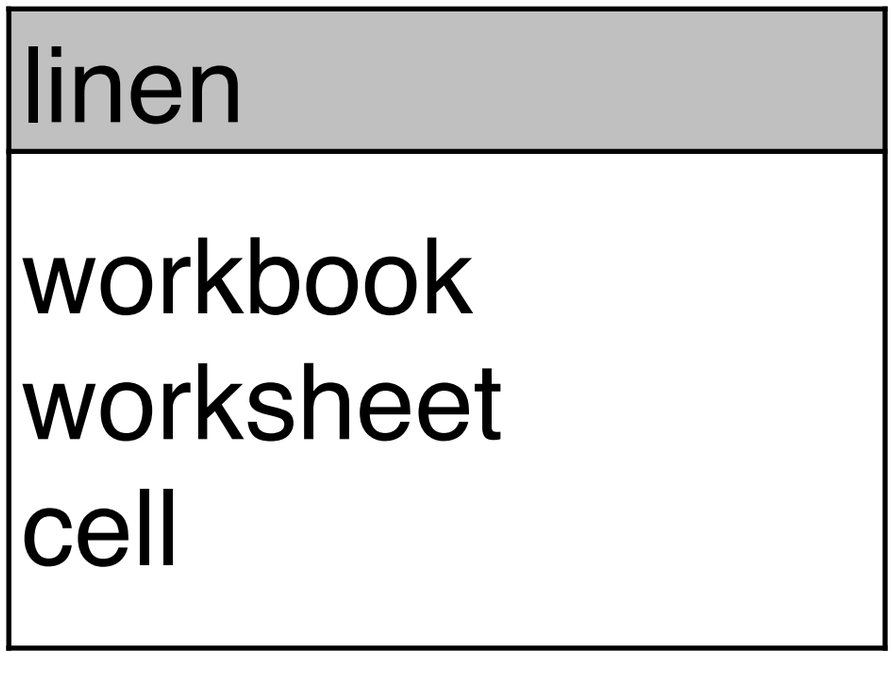
googlesheets

rexcel

data frame

data frame

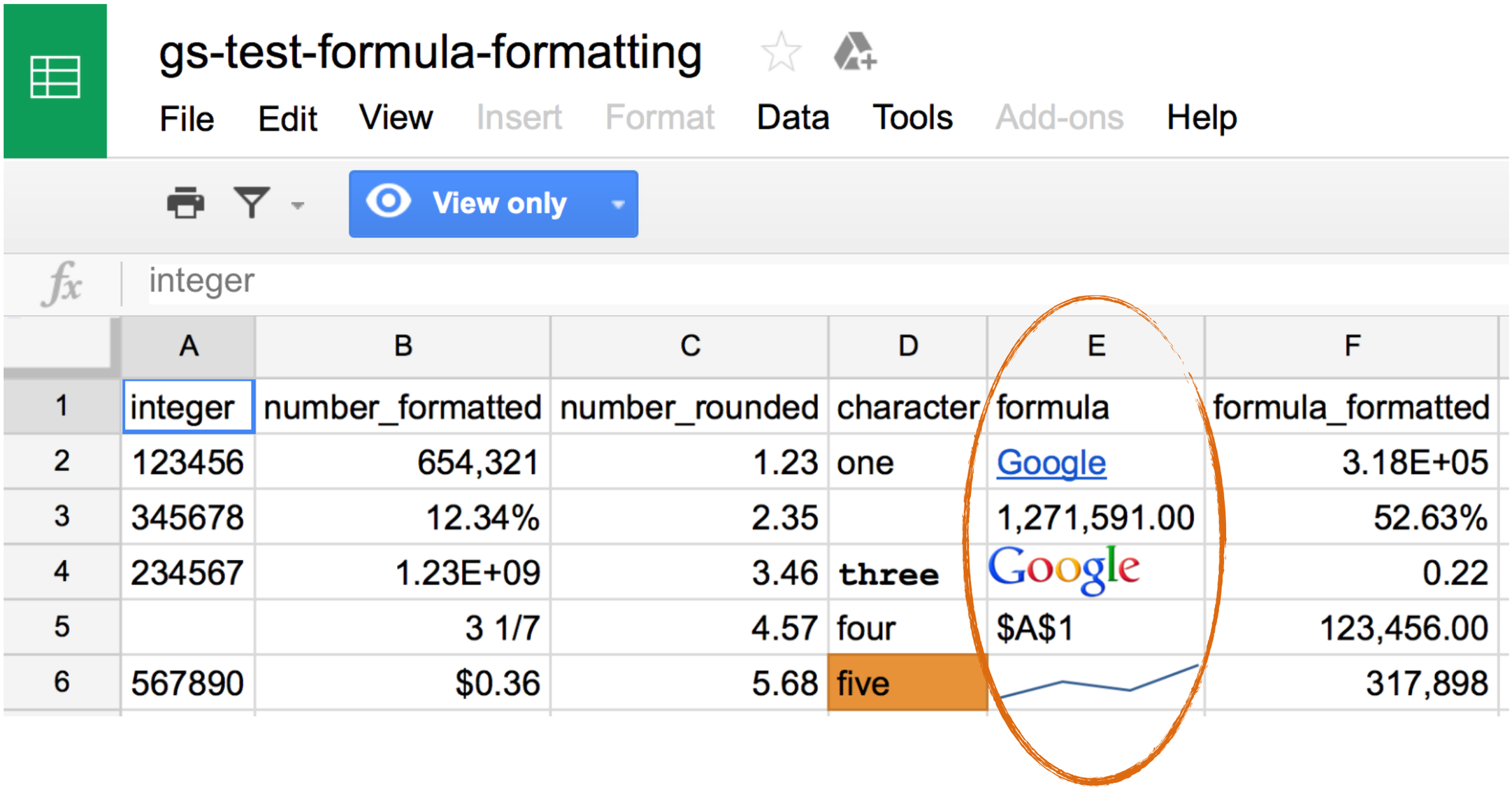
googlesheets



rexcel

jailbreakr

multiple views
unformatted data, formatting
unevaluated formulas
figures?



	A	B	C	D	E	F
1	integer	number_formatted	number_rounded	character	formula	formula_formatted
2	123456	654,321	1.23	one	Google	3.18E+05
3	345678	12.34%	2.35		1,271,591.00	52.63%
4	234567	1.23E+09	3.46	three	Google	0.22
5		3 1/7	4.57	four	A1	123,456.00
6	567890	$0.36	5.68	five		317,898

value	input_value	numeric_value
<chr>	<chr>	<dbl>
Google	=HYPERLINK(“http://www.google.com/“,”Google…	NA
1,271,591.00	=sum(R[-1]C[-4]:R[3]C[-4])	1271591
<NA>	=IMAGE(“https://www.google.com/images/srpr/…	NA
A1	=ADDRESS(1,1)	NA
<NA>	=SPARKLINE(R[-4]C[-4]:R[0]C[-4])	NA

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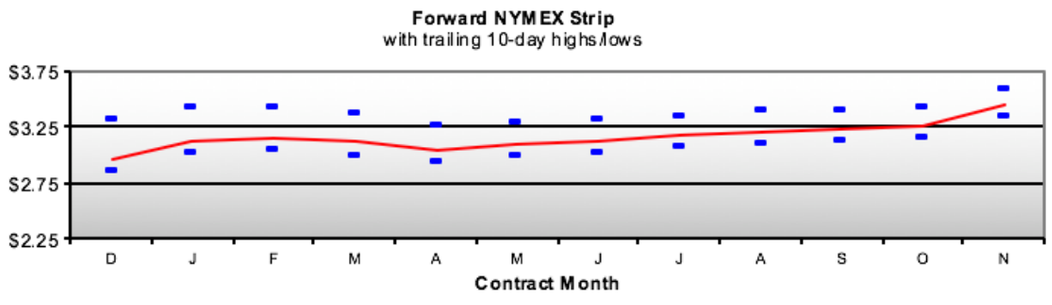

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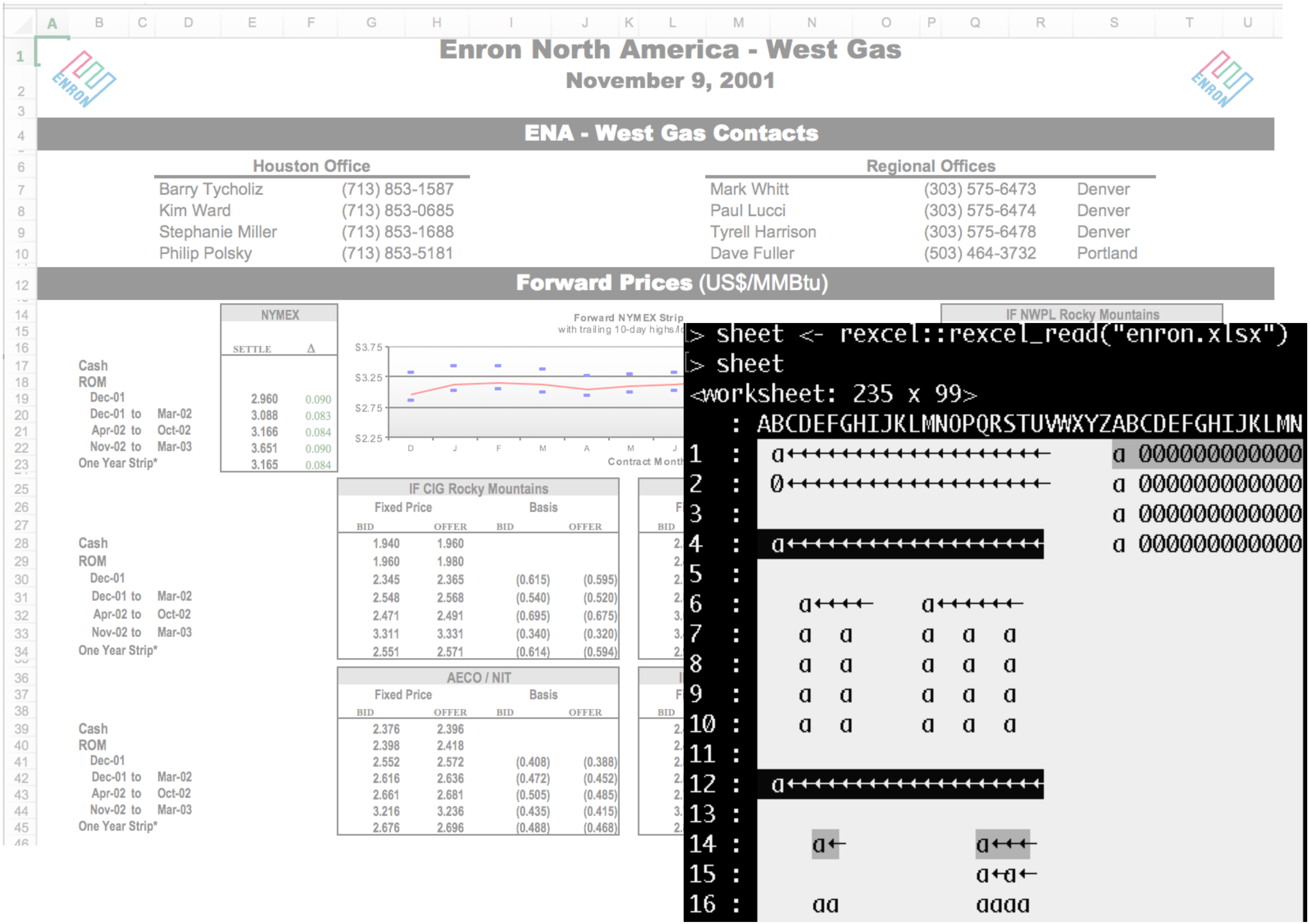
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One Year Strip* 3.165 0.084
Forward NYMEX Strip
Contract Month
IF NWPL Rocky Mountains
IF CIG Rocky Mountains
Fixed Price Basis
BID OFFER BID OFFER
Cash 1.940 1.960
ROM 1.960 1.980
Dec-01 2.345 2.365 (0.615) (0.595)
Dec-01 to Mar-02 2.548 2.568 (0.540) (0.520)
Apr-02 to Oct-02 2.471 2.491 (0.695) (0.675)
Nov-02 to Mar-03 3.311 3.331 (0.340) (0.320)
One Year Strip* 2.551 2.571 (0.614) (0.594)
AECO / NIT
Fixed Price Basis
BID OFFER BID OFFER
Cash 2.376 2.396
ROM 2.398 2.418
Dec-01 2.552 2.572 (0.408) (0.388)
Dec-01 to Mar-02 2.616 2.636 (0.472) (0.452)
Apr-02 to Oct-02 2.661 2.681 (0.505) (0.485)
Nov-02 to Mar-03 3.216 3.236 (0.435) (0.415)
One Year Strip* 2.676 2.696 (0.488) (0.468)
> sheet <- rexcel::rexcel_read("enron.xlsx")
> sheet
<worksheet: 235 x 99>

	AC	AD	AE	AF	AG
115					
116			**Congratulations to Dan Foulston**		
117			**of Canadian Western Natural Gas!!!**		
118			**He is the winner of our weekend getaway**		
119			**to Lake Louise. Dan's guess of $1.375 C/GJ**		
120			**was the closest to the average Aeco**		
121			**day gas price for the first**		
122			**15 days of December.**		

```
113:
114:
115:
116:                                    a
117:                                    a
118:                                    a
119:                                    a
120:                                    a
121:                                    a
122:                                    a
```

Enron North America - West Gas

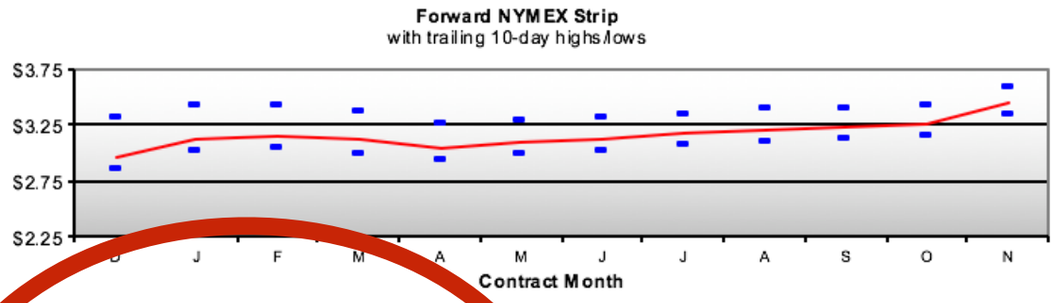
November 9, 2001

ENA - West Gas Contacts

Houston Office		Regional Offices		
Barry Tycholiz	(713) 853-1587	Mark Whitt	(303) 575-6473	Denver
Kim Ward	(713) 853-0685	Paul Lucci	(303) 575-6474	Denver
Stephanie Miller	(713) 853-1688	Tyrell Harrison	(303) 575-6478	Denver
Philip Polsky	(713) 853-5181	Dave Fuller	(503) 464-3732	Portland

Forward Prices (US$/MMBtu)

	NYMEX	
	SETTLE	Δ
Cash		
ROM		
Dec-01	2.960	0.090
Dec-01 to Mar-02	3.088	0.083
Apr-02 to Oct-02	3.166	0.084
Nov-02 to Mar-03	3.651	0.090
One Year Strip*	3.165	0.084



IF NWPL Rocky Mountains			
Fixed Price		Basis	
BID	OFFER	BID	OFFER
1.890	1.910		
2.060	2.080		
2.395	2.415	(0.565)	(0.545)
2.594	2.614	(0.494)	(0.474)
2.581	2.601	(0.585)	(0.565)
3.356	3.376	(0.295)	(0.275)
2.634	2.654	(0.530)	(0.510)

IF CIG Rocky Mountains			
Fixed Price		Basis	
BID	OFFER	BID	OFFER
1.940	1.960		
1.960	1.980		
2.345	2.365	(0.615)	(0.595)
2.548	2.568	(0.540)	(0.520)
2.471	2.491	(0.695)	(0.675)
3.311	3.331	(0.340)	(0.320)
2.551	2.571	(0.614)	(0.59

IF EL Paso Permian			
Fixed Price		Basis	
BID	OFFER	BID	OFFER
2.375	2.395		
2.420	2.440		
2.700	2.720	(0.260)	(0.240)
2.855	2.875	(0.233)	(0.213)
3.009	3.029	(0.158)	(0.138)
3.499	3.519	(0.153)	(0.133)
2.982	3.002	(0.182)	(0.162)

IF EL Paso San Juan			
Fixed Price		Basis	
BID	OFFER	BID	OFFER
2.450	2.470		
2.350	2.370		
2.560	2.580	(0.400)	(0.380)
2.743	2.763	(0.345)	(0.325)
2.801	2.821	(0.365)	(0.345)
3.421	3.441	(0.230)	(0.210)
2.817	2.837	(0.347)	(0.327)

AECO / NIT			
Fixed Price		Basis	
BID	OFFER	BID	OFFER
2.376	2.396		
2.398	2.418		
2.552	2.572	(0.408)	(0.388)
2.616	2.636	(0.472)	(0.452)
2.661	2.681	(0.505)	(0.485)
3.216	3.236	(0.435)	(0.415)
2.676	2.696	(0.488)	(0.468)

IF NWPL Canadian Border (Sumas)			
Fixed Price		Basis	
BID	OFFER	BID	OFFER
2.480	2.500		
2.460	2.480		
2.800	2.820	(0.160)	(0.140)
2.892	2.912	(0.196)	(0.176)
2.796	2.816	(0.370)	(0.350)
3.706	3.726	0.055	0.075
2.880	2.900	(0.285)	(0.265)

IF PEPL TX-OK			
Fixed Price		Basis	
BID	OFFER	BID	OFFER
2.530	2.550		
2.530	2.550		
2.828	2.848	(0.133)	(0.113)
2.958	2.978	(0.130)	(0.110)
3.046	3.066	(0.120)	(0.100)
3.531	3.551	(0.120)	(0.100)
3.041	3.061	(0.123)	(0.103)

Enron North America - West Gas

November 9, 2001

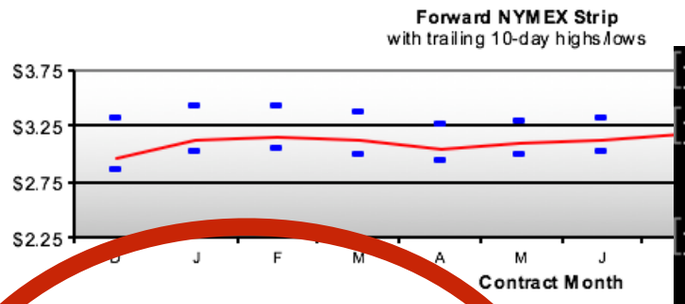
ENA - West Gas Contacts

Houston Office		Regional Offices		
Barry Tycholiz	(713) 853-1587	Mark Whitt	(303) 575-6473	Denver
Kim Ward	(713) 853-0685	Paul Lucci	(303) 575-6474	Denver
Stephanie Miller	(713) 853-1688	Tyrell Harrison	(303) 575-6478	Denver
Philip Polsky	(713) 853-5181	Dave Fuller	(503) 464-3732	Portland

Forward Prices (US$/MMBtu)

NYMEX

	SETTLE	Δ
Cash		
ROM		
Dec-01	2.960	0.090
Dec-01 to Mar-02	3.088	0.083
Apr-02 to Oct-02	3.166	0.084
Nov-02 to Mar-03	3.651	0.090
One Year Strip*	3.165	0.084



IF CIG Rocky Mountains

	Fixed Price BID	Fixed Price OFFER	Basis BID	Basis OFFER
Cash				
ROM				
Dec-01	1.940	1.960		
Dec-01 to Mar-02	1.960	1.980		
Apr-02 to Oct-02	2.345	2.365	(0.615)	(0.595)
Nov-02 to Mar-03	2.548	2.568	(0.540)	(0.520)
One Year Strip*	2.471	2.491	(0.695)	(0.675)
	3.311	3.331	(0.340)	(0.320)
	2.551	2.571	(0.614)	(0.59

AECO / NIT

	Fixed Price BID	Fixed Price OFFER	Basis BID	Basis OFFER
Cash				
ROM				
Dec-01	2.376	2.396		
Dec-01 to Mar-02	2.398	2.418		
Apr-02 to Oct-02	2.552	2.572	(0.408)	(0.388)
Nov-02 to Mar-03	2.616	2.636	(0.472)	(0.452)
One Year Strip*	2.661	2.681	(0.505)	(0.485)
	3.216	3.236	(0.435)	(0.415)
	2.676	2.696	(0.488)	(0.468)

IF NWPL Rocky Mountains

	Fixed Price BID	Basis
	2.375	
	2.420	
	2.700	
	2.855	
	3.009	
	3.499	
	2.982	

IF NW

	Fixed P BID
	2.480
	2.460
	2.800
	2.892
	2.796
	3.706
	2.880

```
> views <- jailbreakr::split_sheet(sheet)
> length(views)
[1] 40
> head(views, 3)
[[1]]
<worksheet_view: 2 x 20 (of 235 x 99)>
  : BCDEFGHIJKLMNOPQRSTU
1: a←←←←←←←←←←←←←←←←←←←
2: 0←←←←←←←←←←←←←←←←←←←

[[2]]
<worksheet_view: 1 x 20 (of 235 x 99)>
  : BCDEFGHIJKLMNOPQRSTU
4: a←←←←←←←←←←←←←←←←←←←

[[3]]
<worksheet_view: 1 x 20 (of 235 x 99)>
  : BCDEFGHIJKLMNOPQRSTU
12: a←←←←←←←←←←←←←←←←←←←
```

IF CIG Rocky Mountains			
Fixed Price		Basis	
BID	OFFER	BID	OFFER
1.940	1.960		
1.960	1.980		
2.345	2.365	(0.615)	(0.595)
2.548	2.568	(0.540)	(0.520)
2.471	2.491	(0.695)	(0.675)
3.311	3.331	(0.340)	(0.320)
2.551	2.571	(0.614)	(0.594)

```
> x2 <- jailbreakr::split_metadata(x1, FALSE, min_data_block=1)
> x3 <- jailbreakr::split_headers_apply(x2, 2)
> x3
<worksheet_view: 7 x 4 (of 235 x 99)>
(with headers)
(with data: metadata)
  : GHIJ
28: 00
29: 00
30: 0000
31: 0000
32: 0000
33: 0000
34: 0000
```

IF CIG Rocky Mountains			
Fixed Price		Basis	
BID	OFFER	BID	OFFER
1.940	1.960		
1.960	1.980		
2.345	2.365	(0.615)	(0.595)
2.548	2.568	(0.540)	(0.520)
2.471	2.491	(0.695)	(0.675)
3.311	3.331	(0.340)	(0.320)
2.551	2.571	(0.614)	(0.594)

```
> x3$values()
     Fixed Price:BID Fixed Price:OFFER Basis:BID Basis:OFFER
[1,] 1.94            1.96              NA        NA
[2,] 1.96            1.98              NA        NA
[3,] 2.345           2.365             -0.615    -0.595
[4,] 2.54775         2.56775           -0.54     -0.52
[5,] 2.471286        2.491286          -0.695    -0.675
[6,] 3.311           3.331             -0.34     -0.32
[7,] 2.55075         2.57075           -0.61375  -0.59375
```

rsheets https://github.com/rsheets

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rexcel

R ★ 6 1

Extracts spreadsheet data fromExcel workbooks and puts into linen format

Updated 8 days ago

enron_corpus_linen

R ★ 0 0

Code to process the enron corpus

Updated 9 days ago

cellranger

R ★ 12 3

Helper functions to work with spreadsheets and the "A1:D10" style of cell range specification

Updated on May 25

linen

R ★ 5 0

General representation of spreadsheet data, plus some limited low-level operations on that data

Updated on May 13

README

★ 0 0

Updated on May 3

jailbreakr

R ★ 3 0

Get out of Excel free.

Updated on May 3

People 2 >

jennybc
Jennifer (Jenny) Bryan

richfitz
Rich FitzJohn

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