Excel Data
logic and errors

Logical Operators

NOT()   returns the opposite of a logical value
          example: NOT(FALSE) is TRUE

AND()   evaluates all inputs and returns FALSE when *any* of them are FALSE
          example: AND(6 > 5, 5 > 4, 4 > 3, 3 < 2) is FALSE

OR()   evaluates all inputs and returns TRUE when *any* of them are TRUE
          example: OR(6 + 3 > 2, 8 / 4 > 2, 2 > 2)

The IF() function takes a logical condition as its first input, what to return if the condition is TRUE as its second input, and what to return if the condition is FALSE as its third input.

IF(<logical test>, <return if true>, <return if false>)

Here are the first few rows of the Starwars data:

	A	B	C	D	E	F	G	H	I	J
1	name	height	mass	hair_color	skin_color	eye_color	age	gender	homeworld	species
2										
3	Luke Skywalker	172	77	blond	fair	blue		19 male	Tatooine	Human
4	C-3PO	167	75	NA	gold	yellow		112 NA	Tatooine	Droid
5	R2-D2	96	32	NA	white, blue	red		33 NA	Naboo	Droid
6	Darth Vader	202	136	none	white	yellow		41.9 male	Tatooine	Human
7	Leia Organa	150	49	brown	light	brown		19 female	Alderaan	Human
8	Owen Lars	178	120	brown, grey	light	blue		52 male	Tatooine	Human
9	Beru Whitesun lars	165	75	brown	light	blue		47 female	Tatooine	Human
10	R5-D4	97	32	NA	white, red	red	NA	NA	Tatooine	Droid
11	Biggs Darklighter	183	84	black	light	brown		24 male	Tatooine	Human
12	Obi-Wan Kenobi	182	77	auburn, white	fair	blue-gray		57 male	Stewjon	Human
13	Anakin Skywalker	188	84	blond	fair	blue		41.9 male	Tatooine	Human
14	Wilhuff Tarkin	180	NA	auburn, grey	fair	blue		64 male	Eriadu	Human
15	Chewbacca	228	112	brown	unknown	blue		200 male	Kashyyyk	Wookiee

What will the following functions return?
1. =IF(B3 > 150, "tall", "short")
2. =IF(D4 = "NA", "unknown", IF(D4 = "brown", "brunette", "not brunette"))

The SWITCH() evaluates an input and returns a value as mapped in result/output pairs.

SWITCH(\<value to evaluate\>, \<match1\>, \<output1\>, \<match2\>, \<output2\>)

- **Can matchup to 126 conditions!!**
- **Cannot use functions, <, or > in the value to evaluate**

fx =SWITCH(M3, "Ground Plane", "Non-Climber", "Above Ground", "Climber")

	D	E	Shift	F	Date	G	H	Age	I	Primary Fur	J Highlight F	K Combinatic	L Color notes	M Location	N Climber?
Squ	Hectare					Hectare Sq									
-10	37F	PM		10142018		3						+			
-10	37E	PM		10062018		3	Adult		Gray		Cinnamon	Gray+Cinnamon		Ground Plane	Non-Climber
10102E		AM		10102018		3	Adult		Cinnamon			Cinnamon+		Above Ground	Climber
10105D		PM		10182018		5	Juvenile		Gray			Gray+		Above Ground	Climber
-10 39B		AM		10182018		1						+		Above Ground	Climber
I-10 33H		AM		10192018		2	Juvenile		Gray		Cinnamon	Gray+Cinnamon		Ground Plane	Non-Climber
10206G		PM		10202018		2	Adult		Gray			Gray+		Ground Plane	Non-Climber
-10 35C		PM		10132018		3			Gray		Cinnamon	Gray+Cinnamon		Ground Plane	Non-Climber
10007B		AM		10082018		9	Adult		Gray			Gray+		Ground Plane	Non-Climber

The columns **Other Activities** and **Other Interactions** columns in the Central Park squirrel data look interesting...but there are also a lot of missing values.
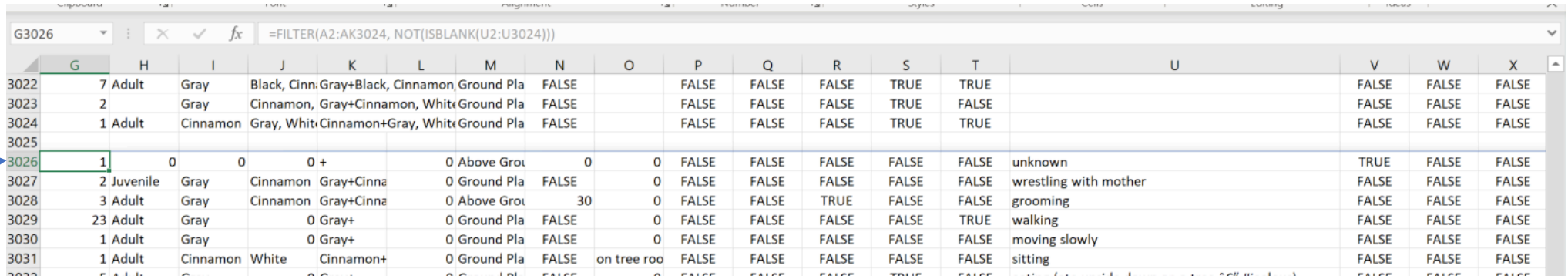
R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
Climbing	Eating	Foraging	Other Activities	Kuks	Quaas	Moans	Tail flags	Tail twitche	Approache:	Indifferent	Runs from	Other Interactions	Lat/Long Zip
FALSE	FALSE	FALSE		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE		POINT (-73.95(
FALSE	FALSE	FALSE		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	me	POINT (-73.95'
TRUE	FALSE	FALSE		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE		POINT (-73.97(
TRUE	FALSE	FALSE		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE		POINT (-73.97!
FALSE	FALSE	FALSE	unknown	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE		POINT (-73.95!
FALSE	FALSE	FALSE	wrestling with mother	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE		POINT (-73.95(
FALSE	FALSE	FALSE		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE		POINT (-73.97:
FALSE	FALSE	TRUE		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE		POINT (-73.96(
FALSE	FALSE	TRUE		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE		POINT (-73.97'
FALSE	TRUE	TRUE		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE		POINT (-73.95!
FALSE	FALSE	TRUE		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE		POINT (-73.97(
FALSE	FALSE	TRUE		FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	TRUE	FALSE		POINT (-73.96:
FALSE	FALSE	TRUE		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE		POINT (-73.95<
FALSE	FALSE	TRUE		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE		POINT (-73.95:
FALSE	FALSE	FALSE		FALSE	FALSE	FALSE	TRUE	TRUE	FALSE	FALSE	FALSE		POINT (-73.96'
TRUE	FALSE	FALSE	grooming	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE		POINT (-73.97:
FALSE	FALSE	TRUE		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE		POINT (-73.96!

Here's how we can filter down to the rows that aren't blank:

1. Use the ISBLANK() function to evaluate whether data is in the cell for each row in the **Other Activities** column (column U).

2. Because you want the rows that return FALSE for ISBLANK(), you next need to wrap the ISBLANK() with NOT().

3. Now you have created the condition for your FILTER(). The first argument is a range to include the entire spreadsheet.

FILTER(A2:AK3024, NOT(ISBLANK(U2:U3024)))

Put this formula below your data.

	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
G3026															=FILTER(A2:AK3024, NOT(ISBLANK(U2:U3024)))			
3022	7	Adult	Gray	Black, Cinn	Gray+Black,	Cinnamon,	Ground Pla	FALSE		FALSE	FALSE	FALSE	TRUE	TRUE		FALSE	FALSE	FALSE
3023	2		Gray	Cinnamon,	Gray+Cinnamon,	White	Ground Pla	FALSE		FALSE	FALSE	FALSE	TRUE	FALSE		FALSE	FALSE	FALSE
3024	1	Adult	Cinnamon	Gray, White	Cinnamon+Gray,	White	Ground Pla	FALSE		FALSE	FALSE	FALSE	TRUE	TRUE		FALSE	FALSE	FALSE
3025																		
3026	1	0	0	0	+		0	Above Grou	0	0	FALSE	FALSE	FALSE	FALSE	FALSE	unknown	TRUE	FALSE	FALSE
3027	2	Juvenile	Gray	Cinnamon	Gray+Cinna		0	Ground Pla	FALSE	0	FALSE	FALSE	FALSE	FALSE	wrestling with mother	FALSE	FALSE	FALSE
3028	3	Adult	Gray	Cinnamon	Gray+Cinna		0	Above Grou	30	0	FALSE	FALSE	TRUE	FALSE	grooming	FALSE	FALSE	FALSE
3029	23	Adult	Gray		0	Gray+		0	Ground Pla	FALSE	0	FALSE	FALSE	FALSE	TRUE	walking	FALSE	FALSE	FALSE
3030	1	Adult	Gray		0	Gray+		0	Ground Pla	FALSE	0	FALSE	FALSE	FALSE	FALSE	moving slowly	FALSE	FALSE	FALSE
3031	1	Adult	Cinnamon	White		Cinnamon+		0	Ground Pla	FALSE	on tree roo	FALSE	FALSE	FALSE	FALSE	sitting	FALSE	FALSE	FALSE

This returns the 437 rows where the **Other Activities** column is not blank:

3023	2		Gray	Cinnamon,	Gray+Cinnamon, White	Ground Pla	FALSE		FALSE	FALSE	FALSE	TRUE	FALSE		FALSE
3024	1	Adult	Cinnamon	Gray, Whit	Cinnamon+Gray, White	Ground Pla	FALSE		FALSE	FALSE	FALSE	TRUE	TRUE		FALSE
3025															
3026	1	0	0	0	+	0	Above Grou	0	0	FALSE	FALSE	FALSE	FALSE	FALSE	unknown	TRUE
3027	2	Juvenile	Gray	Cinnamon	Gray+Cinna	0	Ground Pla	FALSE	0	FALSE	FALSE	FALSE	FALSE	FALSE	wrestling with mother	FALSE
3028	3	Adult	Gray	Cinnamon	Gray+Cinna	0	Above Grou	30	0	FALSE	FALSE	TRUE	FALSE	FALSE	grooming	FALSE
3029	23	Adult	Gray		Gray+	0	Ground Pla	FALSE	0	FALSE	FALSE	FALSE	FALSE	TRUE	walking	FALSE
3030	1	Adult	Gray		Gray+	0	Ground Pla	FALSE	0	FALSE	FALSE	FALSE	FALSE	FALSE	moving slowly	FALSE
3031	1	Adult	Cinnamon	White	Cinnamon+	0	Ground Pla	FALSE	on tree roo	FALSE	FALSE	FALSE	FALSE	FALSE	sitting	FALSE
3032	5	Adult	Gray		Gray+	0	Ground Pla	FALSE	0	FALSE	FALSE	FALSE	TRUE	FALSE	eating (ate upside down on a tree â€" #jealous)	FALSE
3033	1	Adult	Gray	White	Gray+White	0	Ground Pla	FALSE	0	TRUE	FALSE	FALSE	FALSE	FALSE	running (with nut)	FALSE
3034	6	Adult	Gray	Cinnamon	Gray+Cinna	0	Ground Pla	FALSE	0	FALSE	FALSE	FALSE	FALSE	FALSE	playing with #5	FALSE
3035	3	Adult	Gray	Cinnamon	Gray+Cinna	0	Ground Pla	FALSE	0	FALSE	FALSE	FALSE	FALSE	FALSE	hiding nut	FALSE
3036	10	Adult	Gray	White	Gray+White	0	Ground Pla	FALSE	0	FALSE	FALSE	FALSE	FALSE	TRUE	drank from a pond of rain water	FALSE
3037	1	Adult	Gray		Gray+	0	Above Grou	50	0	FALSE	FALSE	TRUE	FALSE	FALSE	sitting	FALSE
3038	3	Adult	Gray		Gray+	0	Above Grou	8	0	FALSE	TRUE	FALSE	FALSE	FALSE	chasing (#4 across trees)	FALSE
3039	1	Adult	Gray	Cinnamon	Gray+Cinna	0	Ground Pla	FALSE	0	FALSE	FALSE	FALSE	FALSE	FALSE	gathering acorns	FALSE
3040	6	Adult	Cinnamon		0 Cinnamon+	0	Ground Pla	FALSE	0	TRUE	FALSE	FALSE	TRUE	TRUE	eating (a mushroom),circles around us,really fat,scratc	FALSE
3041	1	Adult	Gray	Black	Gray+Black	0	Ground Pla	FALSE	0	FALSE	FALSE	FALSE	FALSE	TRUE	digging	FALSE
3042	2	Adult	Gray		Gray+	0	Ground Pla	FALSE	0	TRUE	FALSE	FALSE	FALSE	TRUE	walking	FALSE
3043	4	Adult	Gray		Gray+	0	Above Grou	12	on tree kno	FALSE	FALSE	FALSE	FALSE	FALSE	sitting	FALSE
3044	4	Juvenile	Gray		Gray+	0	Above Grou	10	tree near la	FALSE	FALSE	FALSE	FALSE	FALSE	walking on branch	FALSE
3045	5	Juvenile	Gray	Cinnamon	Gray+Cinna	0	Ground Pla	FALSE	0	FALSE	FALSE	FALSE	FALSE	TRUE	being chased,was pushed by other squirrel	TRUE
3046	1	Adult	Gray	White	Gray+White	0	Above Grou	25	Climbing tr	FALSE	FALSE	TRUE	FALSE	FALSE	climbing (tree)	FALSE
3047	7	0	Gray		Gray+	0	Ground Pla	FALSE	"FIELD"	FALSE	TRUE	FALSE	FALSE	FALSE	chasing #8	FALSE
3048	3	Adult	Gray		Gray+	0	Above Grou	2	bottom of t	FALSE	FALSE	FALSE	TRUE	FALSE	still	FALSE
3049	3	Adult	Gray	Cinnamon	Gray+Cinna	0	Ground Pla	FALSE	0	TRUE	FALSE	FALSE	FALSE	FALSE	stop to look at meâ€"then ran	FALSE

Exercises

1. There is particular interest in squirrel with ID **6D-PM-1020-01**. This squirrel repeatedly runs onto the baseball field and seems fearless of the players on the field. This squirrel was observed in Hectare 06D. Insert a column to the right of the Hectare column. Call it **Near BB Squirrel**. Use a formula to identify squirrels who were observed in adjacent hectares (05D, 07D, 06C, and 06E). Use a filter to isolate just the 31 adjacent squirrels.

2. Find the squirrels that seemed *threatened*. Communicating threats may take the form of **Quaas**, **Moans**, **Tail Flags**, or **Run**(ning) **From** according to the documentation.