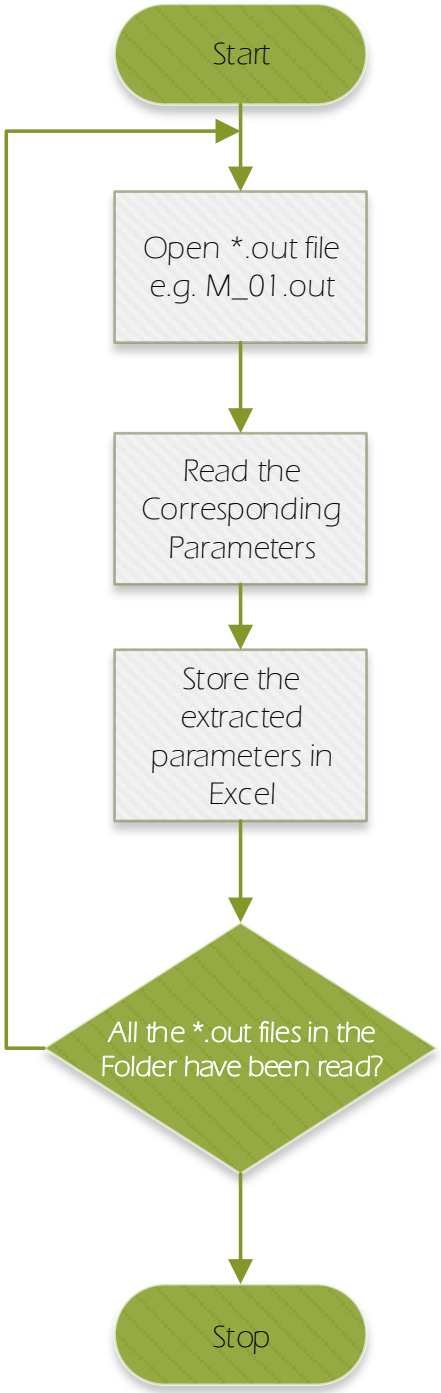
Data Extraction

Data

- Data to be extracted has the extension *.out
- Can be opened using textpad
- Data to be extracted:

No.	Data Name	Unit
1	File Name	.dat
2	OOIP	STB
3	OGIP	SCF
4	RF	%
5	Vg/Vo	rbb/rbb
6	HC/Aquifer	rbbl/rbbl
7	Cumm. Oil Prod.	MSTB
8	Cumm. Water Prod.	MSTB
9	Cumm. Gas Prod.	MMSCF
10	GOR	SCF/STB
11	Water Cut	%
12	Well Length	ft
13	Total Grid	
14	Well Location	



Flowchart

- Each run of the program will extract the parameter values
- Store them and append them in the excel file

Data locations to be extracted in *.out files

Example for files M_01_1.out in Sample Data-1

WARNING!!!

- Because the data is timeseries data → there will be repeated values of the same parameter **BUT different date**
- This is going to be *tricky* because there are cases where:
  1. The value of a parameter is extracted on the END of DATE → RF WARNING-1
  2. The value of a parameter is extracted before its value becomes zero or NA → GOR and WC WARNING-2

OPTIONAL

Program Structure

- To ease finding the extracted parameter, the program may implement the following structure:
  - IF “KEYWORD” = True → Extract the parameter value
  - IF “KEYWORD” = True and “THE LAST DATE” = True → Extract the parameter value
  - IF “KEYWORD” = True and “KEYWORD” = False → Extract the former parameter

1. File Name

```
14
15    Command-line Arguments:   -f D:\Dropbox\Sample Out File\M_01_1.dat
16                              -wd D:\Dropbox\Sample Out File
17                              -log
18                              -wait
```

2. OOIP

```
4594                Hydrocarbon Reservoir Information (including subgrids)
4595                reservoir pore volume:                  17997.       rbbl
4596                total gas in place:                  9.68233E+06     SCF
4597                free gas in place:                   8.31224E+06     SCF
4598                solution gas in place:               1.37009E+06     SCF
4599                total oil in place:                     1408.4       STB
4600                total water in place:                   9129.9       STB
4601                gas cap to oil zone volume ratio:       2.9806       rbb/rbb
4602                hydrocarbon to aquifer volume ratio:    1.1592       rbbl/rbbl
```

3. OGIP

```
4594
4595   Hydrocarbon Reservoir Information (including subgrids)
4596   reservoir pore volume:                    17997.       rbbl
4597   total gas in place:                    9.68233E+06     SCF
4598   free gas in place:                     8.31224E+06     SCF
4599   solution gas in place:                 1.37009E+06     SCF
4600   total oil in place:                     1408.4         STB
4601   total water in place:                   9129.9         STB
4602   gas cap to oil zone volume ratio:       2.9806         rbb/rbb
       hydrocarbon to aquifer volume ratio:    1.1592         rbbl/rbbl
```

4. RF

WARNING-1

```
11623  Percentage Recovery
11624    Stock Tank Oil                  11.746
11625    STO as a % of Mobile Oil        16.119
11626    Total Gas                       43.798
11627    Water                           .00188
```

There are several values of RF in the file, use the LAST DATE as the marker to extract the actual RF

```
11594  ********************************************************************************************************************************
11595  TIME: 1827.0 days                          I M E X   S E C T O R   S U M M A R Y                          DATE: 2025:01:01
11596  ********************************************************************************************************************************
```

NOTE: If different files have different end of date → the program should be able to automatically detect the LAST DATE

Test the program on Sample data-2

5. Vg/Vo

```
4594   Hydrocarbon Reservoir Information (including subgrids)
4595   reservoir pore volume:                    17997.       rbbl
4596   total gas in place:                     9.68233E+06    SCF
4597   free gas in place:                      8.31224E+06    SCF
4598   solution gas in place:                  1.37009E+06    SCF
4599   total oil in place:                       1408.4       STB
4600   total water in place:                     9129.9       STB
4601   gas cap to oil zone volume ratio:         2.9806       rbb/rbb
4602   hydrocarbon to aquifer volume ratio:      1.1592       rbbl/rbbl
```

6. HC/Aquifer

```
4594   Hydrocarbon Reservoir Information (including subgrids)
4595   reservoir pore volume:                    17997.       rbbl
4596   total gas in place:                     9.68233E+06    SCF
4597   free gas in place:                      8.31224E+06    SCF
4598   solution gas in place:                  1.37009E+06    SCF
4599   total oil in place:                       1408.4       STB
4600   total water in place:                     9129.9       STB
4601   gas cap to oil zone volume ratio:         2.9806       rbb/rbb
4602   hydrocarbon to aquifer volume ratio:      1.1592       rbbl/rbbl
```

7. Cumm. Oil Prod.

11708	Field Total	Fluid					
11709		Oil	Gas	Water	Solvent	Polymer	Seawater
11710		-------	-------	-------	-------	-------	-------
11711		(MSTB)	(MMSCF)	(MSTB)	(MMSCF)	(MLB)	(MSTB)
11712	Cumulative Production	.16543	4.2407	171e-6	NA	NA	NA
11713	Cumulative Injection	NA	0	0	NA	NA	NA
11714	Cumulative Gas Lift	NA	0	NA	NA	NA	NA
11715	Cumulative Water Influx	NA	NA	0	NA	NA	NA
11716	Current Fluids In Place	1.2437	5.5816	9.1329	NA	NA	NA
11717	Production Rates	0	0	0	NA	NA	NA
11718	Injection Rates	NA	0	0	NA	NA	NA

8. Cumm. Water Prod.

11708	Field Total	Fluid					
11709		Oil	Gas	Water	Solvent	Polymer	Seawater
11710		-------	-------	-------	-------	-------	-------
11711		(MSTB)	(MMSCF)	(MSTB)	(MMSCF)	(MLB)	(MSTB)
11712	Cumulative Production	.16543	4.2407	171e-6	NA	NA	NA
11713	Cumulative Injection	NA	0	0	NA	NA	NA
11714	Cumulative Gas Lift	NA	0	NA	NA	NA	NA
11715	Cumulative Water Influx	NA	NA	0	NA	NA	NA
11716	Current Fluids In Place	1.2437	5.5816	9.1329	NA	NA	NA
11717	Production Rates	0	0	0	NA	NA	NA
11718	Injection Rates	NA	0	0	NA	NA	NA

9. Cumm. Gas Prod.

Field Total	Fluid					
	Oil	Gas	Water	Solvent	Polymer	Seawater
	(MSTB)	(MMSCF)	(MSTB)	(MMSCF)	(MLB)	(MSTB)
Cumulative Production	.16543	4.2407	171e-6	NA	NA	NA
Cumulative Injection	NA	0	0	NA	NA	NA
Cumulative Gas Lift	NA	0	NA	NA	NA	NA
Cumulative Water Influx	NA	NA	0	NA	NA	NA
Current Fluids In Place	1.2437	5.5816	9.1329	NA	NA	NA
Production Rates	0	0	0	NA	NA	NA
Injection Rates	NA	0	0	NA	NA	NA

10. GOR

WARNING-2

```
5262  DATE 2020 6  1.00000
5263
5264  ===================== SUMMARY (from subroutine: INWELL) ======================
5265   Reading of well data is complete.
5266   Simulation will stop if there were error messages.
5267      0 Warning messages.    0 Error messages.
5268  ================================================================================
5269
5270
5271                                  I M E X   T I M E   S T E P   S U M M A R Y
5272  ================================================================================================================
5273     Time Step          Time                  Total Production                    Total Injection  Total Max. Max. Change
5274  ---------------- ---------------- ------------------------------------------ ----------------- PV   Mat. ------------
5275                 C                      Oil      Gas      Water   GOR.  Wat.    Gas      Water   Avg.  bal. Satur. Pres.
5276        Size     U                                                  SCF/  Cut                    Pres. err. DSMAX  DPMAX
5277   No.  Days IT T Days   yy:mm:dd   STB/D    MCF/D    STB/D     STB   %     MCF/D    STB/D    psia   %          psia
5278  ------ ---- -- - ----- ---------- -------- -------- -------- ----- ----- -------- -------- ----- ---- ------ -----
5279     30w 5.91 5  0 157.9 2020:06:07 1.000000 52.86245 .0056120 52862 .5581                     2035 2.3g -.079w  -102
5280     31  7.52 7  0 165.4 2020:06:14 1.000000 57.99761 .0139739 57998 1.378                     1895 2.5g -.145w  -141
5281
```

Extract at this date

```
5396  DATE 2020 7  1.00000
5397
5398  ===================== SUMMARY (from subroutine: INWELL) ======================
5399   Reading of well data is complete.
5400   Simulation will stop if there were error messages.
5401      0 Warning messages.    0 Error messages.
5402  ================================================================================
5403
5404
5405                                  I M E X   T I M E   S T E P   S U M M A R Y
5406  ================================================================================================================
5407     Time Step          Time                  Total Production                    Total Injection  Total Max. Max. Change
5408  ---------------- ---------------- ------------------------------------------ ----------------- PV   Mat. ------------
5409                 C                      Oil      Gas      Water   GOR.  Wat.    Gas      Water   Avg.  bal. Satur. Pres.
5410        Size     U                                                  SCF/  Cut                    Pres. err. DSMAX  DPMAX
5411   No.  Days IT T Days   yy:mm:dd   STB/D    MCF/D    STB/D     STB   %     MCF/D    STB/D    psia   %          psia
5412  ------ ---- -- - ----- ---------- -------- -------- -------- ----- ----- -------- -------- ----- ---- ------ -----
5413     35w 10.4 1  0 192.4 2020:07:11                                                          1897 2.5g -.063g -.255
5414     36  10.3 7  0 202.7 2020:07:22                                                          1898 2.5g  .052w  .359
5415     37  10.3 1  0 213.0 2020:08:01                                                          1898 2.5g -.041g  .219
```

Not in this date

GOR = NA = 0

11. Water Cut

WARNING-2

```
DATE 2020 6  1.00000

===================== SUMMARY (from subroutine: INWELL) ======================
 Reading of well data is complete.
 Simulation will stop if there were error messages.
    0 Warning messages.    0 Error messages.
==============================================================================


                                  I M E X   T I M E   S T E P   S U M M A R Y
=================================================================================================================================
   Time Step           Time                  Total Production                    Total Injection  Total Max. Max. Change
---------------- ---------------- ------------------------------------- ------------------ PV   Mat. ------------
          C                        Oil      Gas      Water   GOR.  Wat.    Gas      Water   Avg.  bal. Satur. Pres.
      Size U                                                  SCF/  Cut                      Pres. err. DSMAX  DPMAX
 No.  Days IT T Days   yy:mm:dd    STB/D    MCF/D    STB/D    STB   %     MCF/D    STB/D    psia   %          psia
------ ---- -- - ----- ---------- -------- -------- -------- ----- ----- -------- -------- ----- ---- ------ -----
   30w 5.91 5  0 157.9 2020:06:07 1.000000 52.86245 .0056120 52862 .5581                     2035 2.3g -.079w  -102
   31  7.52 7  0 165.4 2020:06:14 1.000000 57.99761 .0139739 57998 1.378                     1895 2.5g -.145w  -141
```

For Water Cut: The extraction follows the same rule like GOR

12. Well Length

This must be summed up into single value

```
LAYERXYZ  'Well-1'
** perf geometric data: UBA, block entry(x,y,z) block exit(x,y,z), length
    200 1 1  997.500000  2.500000  7987.752000  997.500000  2.500000  7992.752000  5.000000
    200 1 2  997.500000  2.500000  7992.752000  997.500000  2.500000  7997.752000  5.000000
    200 1 3  997.500000  2.500000  7997.752000  997.500000  2.500000  8002.752000  5.000000
    200 1 4  997.500000  2.500000  8002.752000  1000.000000  2.500000  8007.658063  5.000000
    201 1 4  1000.000000  2.500000  8007.658063  1000.551666  2.500000  8008.189000  0.765657
    201 1 5  1000.551666  2.500000  8008.189000  1005.000000  2.500000  8010.346778  5.220017
    202 1 5  1005.000000  2.500000  8010.346778  1010.000000  2.500000  8010.912085  5.031856
    203 1 5  1010.000000  2.500000  8010.912085  1015.000000  2.500000  8011.477392  5.031856
    204 1 5  1015.000000  2.500000  8011.477392  1020.000000  2.500000  8012.042699  5.031856
    205 1 5  1020.000000  2.500000  8012.042699  1025.000000  2.500000  8012.319419  5.015935
    206 1 5  1025.000000  2.500000  8012.319419  1030.000000  2.500000  8012.307554  5.000014
    207 1 5  1030.000000  2.500000  8012.307554  1035.000000  2.500000  8012.295688  5.000014
    208 1 5  1035.000000  2.500000  8012.295688  1040.000000  2.500000  8012.283822  5.000014
    209 1 5  1040.000000  2.500000  8012.283822  1045.000000  2.500000  8012.271957  5.000014
    210 1 5  1045.000000  2.500000  8012.271957  1050.000000  2.500000  8012.260091  5.000014
    211 1 4  1[illegible]                                                0000  8012.248225  5.000014
    212 1 4  1[illegible]                                                0000  8012.236359  5.000014
    213 1 4  1[illegible]                                                0000  8012.224494  5.000014
    214 1 4  1[illegible]                                                0000  8012.212628  5.000014
    215 1 4  1[illegible]                                                0000  8012.200762  5.000014
    216 1 4  1[illegible]                                                0000  8012.188896  5.000014
    217 1 4  1[illegible]                                                0000  8012.177031  5.000014
    218 1 4  1085.000000  2.500000  8012.177031  1090.000000  2.500000  8012.165165  5.000014
    219 1 4  1090.000000  2.500000  8012.165165  1095.000000  2.500000  8012.153299  5.000014
    220 1 4  1095.000000  2.500000  8012.153299  1100.000000  2.500000  8012.141434  5.000014
    221 1 4  1100.000000  2.500000  8012.141434  1105.000000  2.500000  8012.129568  5.000014
    222 1 3  1105.000000  2.500000  8012.129568  1110.000000  2.500000  8012.117702  5.000014
    223 1 3  1110.000000  2.500000  8012.117702  1115.000000  2.500000  8012.105836  5.000014
    224 1 3  1115.000000  2.500000  8012.105836  1120.000000  2.500000  8012.093971  5.000014
    225 1 3  1120.000000  2.500000  8012.093971  1125.000000  2.500000  8012.082105  5.000014
    226 1 3  1125.000000  2.500000  8012.082105  1130.000000  2.500000  8012.070239  5.000014
    227 1 3  1130.000000  2.500000  8012.070239  1132.625000  2.500000  8012.062573  2.625012
```

= 153.7225

Add a feature to disable this parameter (well length) extraction in case there is no output to be read

Test the program on File: M_47_2994.out that doesn't contain this value

13. Total Grid

```
449
450                                  **************************
451                                  * SIMULATION PARAMETERS *
452                                  **************************
453
454
455
456                          Number of grid blocks in x direction:          400
457                          Number of grid blocks in y direction:            1
458                          Number of grid blocks in z direction:           10
459                          Total number of grid blocks:                  4000
460
461                          Number of equations:                             3
462                          Number of orthogonalizations:                   30
463                          Maximum number of Newton iterations:            10
```

14. Well Location

Example from Sample Data-1 (M_01_1.out)

The length of this array varies at certain *.out file

```
272  ** UBA          ff          Status   Connection
273     200 1 1      1.0   OPEN  FLOW-TO   'SURFACE'
274     200 1 2      1.0   OPEN  FLOW-TO   1
275     200 1 3      1.0   OPEN  FLOW-TO   2
276     200 1 4      1.0   OPEN  FLOW-TO   3   REFLAYER
277     201 1 4      1.0   OPEN  FLOW-TO   4
278     201 1 5      1.0   OPEN  FLOW-TO   5
279     202 1 5      1.0   OPEN  FLOW-TO   6
280     203 1 5      1.0   OPEN  FLOW-TO   7
281     204 1 5      1.0   OPEN  FLOW-TO   8
282     205 1 5      1.0   OPEN  FLOW-TO   9
283     206 1 5      1.0   OPEN  FLOW-TO   10
284     207 1 5      1.0   OPEN  FLOW-TO   11
285     208 1 5      1.0   OPEN  FLOW-TO   12
286     209 1 5      1.0   OPEN  FLOW-TO   13
287     210 1 5      1.0   OPEN  FLOW-TO   14
288     211 1 4      1.0   OPEN  FLOW-TO   15
289     212 1 4      1.0   OPEN  FLOW-TO   16
290     213 1 4      1.0   OPEN  FLOW-TO   17
291     214 1 4      1.0   OPEN  FLOW-TO   18
292     215 1 4      1.0   OPEN  FLOW-TO   19
293     216 1 4      1.0   OPEN  FLOW-TO   20
294     217 1 4      1.0   OPEN  FLOW-TO   21
295     218 1 4      1.0   OPEN  FLOW-TO   22
296     219 1 4      1.0   OPEN  FLOW-TO   23
297     220 1 4      1.0   OPEN  FLOW-TO   24
298     221 1 4      1.0   OPEN  FLOW-TO   25
299     222 1 3      1.0   OPEN  FLOW-TO   26
300     223 1 3      1.0   OPEN  FLOW-TO   27
301     224 1 3      1.0   OPEN  FLOW-TO   28
302     225 1 3      1.0   OPEN  FLOW-TO   29
303     226 1 3      1.0   OPEN  FLOW-TO   30
304     227 1 3      1.0   OPEN  FLOW-TO   31
```

Values to be extracted

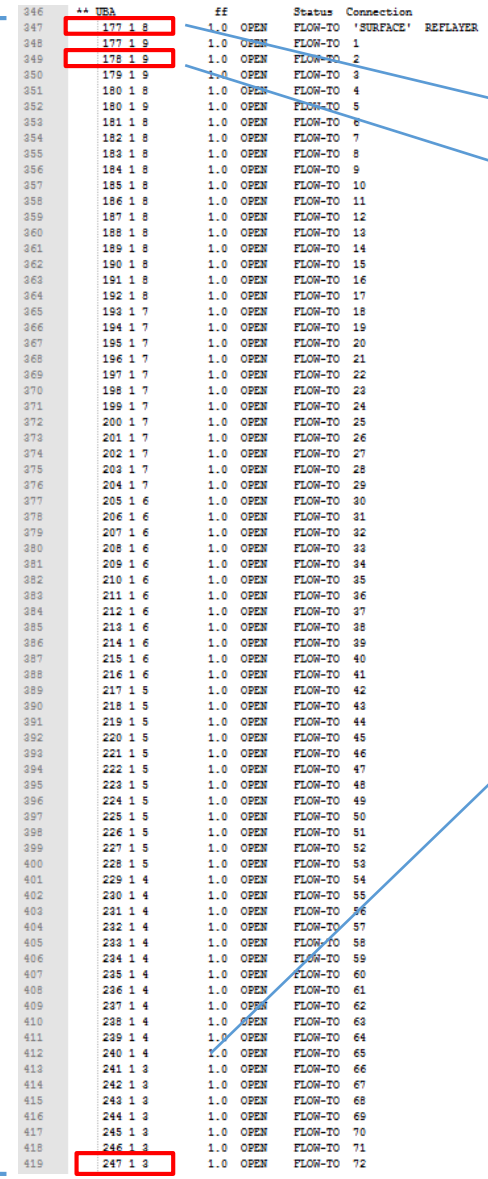
Loc	i	j	k
1	200	1	1
2	200	1	3
3	227	1	3

- Loc-1: the values are at 1st line
- Loc-2: the values are at 2nd line
- Loc-3: the values are at the end of array

14. Well Location

Example from Sample Data-2 (M_01_1.out)

The length of this array varies at certain *.out file



```
** UBA          ff        Status  Connection
   177 1 8      1.0  OPEN    FLOW-TO  'SURFACE'  REFLAYER
   177 1 9      1.0  OPEN    FLOW-TO  1
   178 1 9      1.0  OPEN    FLOW-TO  2
   179 1 9      1.0  OPEN    FLOW-TO  3
   180 1 8      1.0  OPEN    FLOW-TO  4
   180 1 9      1.0  OPEN    FLOW-TO  5
   181 1 8      1.0  OPEN    FLOW-TO  6
   182 1 8      1.0  OPEN    FLOW-TO  7
   183 1 8      1.0  OPEN    FLOW-TO  8
   184 1 8      1.0  OPEN    FLOW-TO  9
   185 1 8      1.0  OPEN    FLOW-TO  10
   186 1 8      1.0  OPEN    FLOW-TO  11
   187 1 8      1.0  OPEN    FLOW-TO  12
   188 1 8      1.0  OPEN    FLOW-TO  13
   189 1 8      1.0  OPEN    FLOW-TO  14
   190 1 8      1.0  OPEN    FLOW-TO  15
   191 1 8      1.0  OPEN    FLOW-TO  16
   192 1 8      1.0  OPEN    FLOW-TO  17
   193 1 7      1.0  OPEN    FLOW-TO  18
   194 1 7      1.0  OPEN    FLOW-TO  19
   195 1 7      1.0  OPEN    FLOW-TO  20
   196 1 7      1.0  OPEN    FLOW-TO  21
   197 1 7      1.0  OPEN    FLOW-TO  22
   198 1 7      1.0  OPEN    FLOW-TO  23
   199 1 7      1.0  OPEN    FLOW-TO  24
   200 1 7      1.0  OPEN    FLOW-TO  25
   201 1 7      1.0  OPEN    FLOW-TO  26
   202 1 7      1.0  OPEN    FLOW-TO  27
   203 1 7      1.0  OPEN    FLOW-TO  28
   204 1 7      1.0  OPEN    FLOW-TO  29
   205 1 6      1.0  OPEN    FLOW-TO  30
   206 1 6      1.0  OPEN    FLOW-TO  31
   207 1 6      1.0  OPEN    FLOW-TO  32
   208 1 6      1.0  OPEN    FLOW-TO  33
   209 1 6      1.0  OPEN    FLOW-TO  34
   210 1 6      1.0  OPEN    FLOW-TO  35
   211 1 6      1.0  OPEN    FLOW-TO  36
   212 1 6      1.0  OPEN    FLOW-TO  37
   213 1 6      1.0  OPEN    FLOW-TO  38
   214 1 6      1.0  OPEN    FLOW-TO  39
   215 1 6      1.0  OPEN    FLOW-TO  40
   216 1 6      1.0  OPEN    FLOW-TO  41
   217 1 5      1.0  OPEN    FLOW-TO  42
   218 1 5      1.0  OPEN    FLOW-TO  43
   219 1 5      1.0  OPEN    FLOW-TO  44
   220 1 5      1.0  OPEN    FLOW-TO  45
   221 1 5      1.0  OPEN    FLOW-TO  46
   222 1 5      1.0  OPEN    FLOW-TO  47
   223 1 5      1.0  OPEN    FLOW-TO  48
   224 1 5      1.0  OPEN    FLOW-TO  49
   225 1 5      1.0  OPEN    FLOW-TO  50
   226 1 5      1.0  OPEN    FLOW-TO  51
   227 1 5      1.0  OPEN    FLOW-TO  52
   228 1 5      1.0  OPEN    FLOW-TO  53
   229 1 4      1.0  OPEN    FLOW-TO  54
   230 1 4      1.0  OPEN    FLOW-TO  55
   231 1 4      1.0  OPEN    FLOW-TO  56
   232 1 4      1.0  OPEN    FLOW-TO  57
   233 1 4      1.0  OPEN    FLOW-TO  58
   234 1 4      1.0  OPEN    FLOW-TO  59
   235 1 4      1.0  OPEN    FLOW-TO  60
   236 1 4      1.0  OPEN    FLOW-TO  61
   237 1 4      1.0  OPEN    FLOW-TO  62
   238 1 4      1.0  OPEN    FLOW-TO  63
   239 1 4      1.0  OPEN    FLOW-TO  64
   240 1 4      1.0  OPEN    FLOW-TO  65
   241 1 3      1.0  OPEN    FLOW-TO  66
   242 1 3      1.0  OPEN    FLOW-TO  67
   243 1 3      1.0  OPEN    FLOW-TO  68
   244 1 3      1.0  OPEN    FLOW-TO  69
   245 1 3      1.0  OPEN    FLOW-TO  70
   246 1 3      1.0  OPEN    FLOW-TO  71
   247 1 3      1.0  OPEN    FLOW-TO  72
```

Values to be extracted

Loc	i	j	k
1	177	1	8
2	178	1	9
3	247	1	3

- Loc-1: the values are at 1st line
- Loc-2: the values are at 2nd line
- Loc-3: the values are at the end of array

Sample Extracted Parameters that Stored in Excel

No.	File Name (dat)	OOIP (STB)	OGIP (SCF)	RF (%)	Vg/Vo (rbb/rbb)	HC/Aquifer (rbbl/rbbl)	Cumm. Oil Prod. (MSTB)	Cumm. Water Prod. (MSTB)	Cumm. Gas Prod. (MMSCF)	GOR	Water Cut (%)	Well Length (ft)	Total Grid	Well Location
1	M_01_1	1408.4	9.683E+06	11.746	2.9806	1.1592	0.16543	1.71E-04	4.2407	57997.61	1.378	153.7225	4000	200 1 1 200 1 3 227 1 3

IDE

- Jupyter Notebook
- Spyder