JEGR_Examen.R

Javier Elias Gloria Rodriguez

2025-11-22

```r
# Examen parcial
# Javier Elias Gloria Rodriguez
# 22/10/2025

read.csv("https://www.dropbox.com/s/3pi3huovq6qce42/obs.csv?dl=1")
```

```
##       X      e      n elev zone wrb1   LC Clay1 Clay2 Clay5 CEC1 CEC2
CEC5
## 1     1 702638 326959  657    2    3   FF    72    74    78 13.6 10.1
7.1
## 2     2 701659 326772  628    2    3   FF    71    75    80 12.6  8.2
7.4
## 3     3 703488 322133  840    1    3   FV    61    59    66 21.7 10.2
6.6
## 4     4 703421 322508  707    1    3   FV    55    62    61 11.6  8.4
8.0
## 5     5 703358 322846  670    2    3   FV    47    56    53 14.9  9.2
8.5
## 6     6 702334 324551  780    1    3   FV    49    53    57 18.2 11.6
6.2
## 7     7 681328 311602  720    1    3   FF    63    66    70 14.9  7.4
5.4
## 8     8 681508 311295  657    2    3   FF    59    66    72 14.6  7.1
7.0
## 9     9 681230 311053  600    2    3   FV    46    56    70  7.9  5.7
4.5
## 10   10 683989 311685  720    1    3   FV    62    63    62 14.9  6.8
6.0
## 11   11 697665 337414  640    2    3   FV    45    48    51 15.8  9.2
6.5
## 12   12 696905 337974  588    2    3   FV    36    45    55 12.5  5.5
5.8
## 13   13 692420 324675 1000    1    2   FV    48    50    54 23.3 13.9
10.8
## 14   14 692539 322735  880    1    2   FV    28    35    35 13.2  9.7
10.3
## 15   15 692687 325952  780    1    2   FV    22    28    35  8.7  6.7
8.5
## 16   16 692993 327812  615    2    3   FV    52    50    58 19.4 15.0
8.1
## 17   17 680981 310897  591    2    3   FF    20    39    43  5.9  3.5
3.8
## 18   18 685992 313274  668    2    3   FV    33    43    56  7.0  2.5
2.6
```

```
## 19   19 679277 325801  380    3    3   FV    21    27    34  7.1  4.7
4.9
## 20   20 679890 326164  362    3    3   FV    22    34    37  7.3  5.5
4.3
## 21   21 682720 326752  367    3    3   FV    26    24    41 13.0  6.7
5.8
## 22   22 670379 335769  240    4    1   FF    38    46    54  8.6  5.6
5.5
## 23   23 670594 336095  210    4    1   FF    32    35    48 20.1  5.2
6.4
## 24   24 690278 336749  487    3    3   FV    49    52    56 17.8 13.6
9.3
## 25   25 690441 337232  436    3    3   FV    37    34    45 18.8  6.0
5.0
## 26   26 679593 337271  424    3    1   FV    30    36    43 10.0  6.2
5.3
## 27   27 679242 338073  360    3    1   FV    24    35    51  5.0  5.4
13.1
## 28   28 684468 337629  440    3    3   FV    38    45    55 10.8  8.8
9.2
## 29   29 684374 338166  440    3    3   FV    23    28    38 14.4  5.7
6.2
## 30   30 684199 339579  430    3    3   FV    27    38    46 12.6  6.8
6.5
## 31   31 697749 337608  612    2    3   FV    29    42    48  4.7  2.8
3.8
## 32   32 696813 337461  555    2    3   FV    36    37    48 13.4  8.2
9.3
## 33   33 659576 336644   95    4    1   BF    19    27    40  9.9  3.8
4.1
## 34   34 659822 337154   82    4    1   BF    10    16    31  3.0  1.8
2.3
## 35   35 666108 327786  160    4    1   FV    23    28    35 10.7  7.3
5.6
## 36   36 665629 326619  158    4    1   FV    16    23    32  4.2  2.2
2.7
## 37   37 664564 326227  140    4    1   FV    21    29    33 10.1  4.9
3.3
## 38   38 671039 336819  130    4    1  OCA    13    23    40  4.8  3.4
3.2
## 39   39 670754 336391  160    4    1   FF    10     8    19  7.7  2.4
1.5
## 40   40 668197 336015  196    4    1   FV    13    11    27  9.0  4.9
7.4
## 41   41 667870 335555  237    4    1   FV    15    18    33  5.3  3.4
4.3
## 42   42 667325 334883  243    4    1   FV    23    38    48  3.9  4.2
4.9
## 43   43 666506 337233  136    4    1   BF    15    24    33 11.6  6.1
7.9
```

```
## 44   44 687124 339817  432    3    3   BF    29    41    46 13.6 13.6
13.6
## 45   45 695689 328317  540    2    3   BF    39    47    53 12.7  8.9
8.1
## 46   46 674846 323759  362    3    3  MCA    18    25    32  7.0  5.0
5.0
## 47   47 674723 323431  352    3    3   FV    22    36    38 10.0 11.0
3.0
## 48   48 694940 327718  578    2    3   CF    42    49    54 12.2  7.7
8.9
## 49   49 666562 337348  136    4    1   CF    15    14    27  7.5  1.7
6.5
## 50   50 686360 339248  438    3    3   FF    25    30    33  7.0  7.0
7.0
## 51   51 686046 339368  451    3    3  MCA    25    29    40  6.0  6.0
6.0
## 52   52 686499 339117  458    3    3   FV    33    40    53  8.0  8.0
9.0
## 53   53 686009 339249  454    3    3   FV    35    40    43  9.0  9.0
7.0
## 54   54 695904 328844  556    2    3   CF    54    57    65 13.6 11.8
11.2
## 55   55 675278 324063  365    3    3  OCA    22    29    41  6.0  5.0
5.0
## 56   56 675653 324016  358    3    3   FV    33    37    41 14.0  9.0
8.0
## 57   57 675329 319898  406    3    3  OCA    24    33    42  7.0  5.0
9.0
## 58   58 675761 319789  415    3    3   FV    33    40    44 14.0  7.0
6.0
## 59   59 687818 339602  424    3    3   CF    34    31    45 10.0  6.0
12.0
## 60   60 686982 339433  440    3    3   BF    22    30    45  4.5  6.0
6.8
## 61   61 695235 326737  653    2    3   BF    43    51    57 10.0 10.8
10.0
## 62   62 695205 326737  640    2    3   BF    43    51    57 10.0 10.8
10.0
## 63   63 665872 336698  185    4    1  OCA    13    15    30 19.0  9.0
5.0
## 64   64 666137 336534  208    4    1   FV    18    19    25  5.0  2.0
1.0
## 65   65 662629 336481   82    4    1   FF    14    15    32 13.0  5.0
6.0
## 66   66 662532 336506   82    4    1   FV    14    15    32 13.0  5.0
6.0
## 67   67 673859 319080  400    3    3   CF    20    24    36  9.0  6.0
5.0
## 68   68 673670 319091  400    3    3  OCA    18    21    38  6.0  5.0
6.0
```

```
## 69   69 674436 319681  405    3    3  MCA    35    42    44  8.0  7.0
8.0
## 70   70 673754 319123  405    3    3   FV    33    36    40 13.0 13.0
10.0
## 71   71 674683 319769  400    3    3   FV    32    34    43 12.0 11.0
9.0
## 72   72 694832 327910  560    2    3   BF    37    44    48 12.6  9.4
9.3
## 73   73 689860 341727  440    3    3  OCA    25    35    45 23.0 22.0
10.0
## 74   74 690096 342170  430    3    3  MCA    34    42    40  8.0  7.0
8.0
## 75   75 689456 342064  460    3    3   FV    32    34    43 12.0 11.0
9.0
## 76   76 690102 342379  443    3    3   FV    34    37    44 12.0 11.0
9.0
## 77   77 673056 323431  388    3    3   FF    44    50    54 22.6 11.6
7.8
## 78   78 673041 323306  398    3    3   FV    53    54    57 29.0 11.2
5.9
## 79   79 673606 322713  368    3    3   CF    50    51    57 17.6 10.1
8.1
## 80   80 671496 322819  320    3    3   FF    45    44    57 28.2 11.2
5.9
## 81   81 671483 322862  325    3    3   FV    46    38    44 28.0  7.0
6.0
## 82   82 659401 336922   90    4    1   BF    12    12    31  3.9  1.6
3.7
## 83   83 695219 326264  600    2    3   BF    55    58    60 20.6  9.4
9.9
## 84   84 697673 329144  590    2    3  OCA    15    18    27  7.0  8.0
8.0
## 85   85 697580 329339  600    2    3   FV    36    48    52 10.0 13.0
14.0
## 86   86 688397 340081  436    3    3  OCA    43    42    52 13.0 12.0
11.0
## 87   87 688132 340335  442    3    3   FV    40    47    50 13.0 13.0
12.0
## 88   88 674393 319117  400    3    3   BF    26    36    47  6.8  3.9
2.3
## 89   89 694670 327737  573    2    3   CF    39    47    55 10.5  8.8
8.3
## 90   90 665317 336226  160    4    1   FF    17    19    25 13.0  5.0
5.0
## 91   91 665258 336333  150    4    1   FV    14    18    20 10.0  6.0
6.0
## 92   92 673550 318214  425    3    3 YANA    33    37    46 12.0  8.0
6.0
## 93   93 673475 318157  426    3    3   FV    30    35    45 19.0  8.0
5.0
```

```
## 94   94 670672 320434  340    3    3  YOP    36    41    49 18.0 10.0
9.0
## 95   95 670188 320542  340    3    3   FV    32    38    47 11.0  6.0
5.0
## 96   96 672706 319431  465    3    3   CF    25    33    44  5.0  4.0
5.0
## 97   97 694955 327879  560    2    3   BF    45    51    55 10.6 10.4
6.2
## 98   98 687782 339579  425    3    3   FF    30    36    47 10.3  7.0
7.0
## 99   99 687768 339501  426    3    3   FV    30    32    45  9.5  4.6
6.7
## 100 100 671668 321724  350    3    1  OCA    29    35    42  6.0  5.0
5.0
## 101 101 671627 322081  360    3    1   FV    33    34    40 16.0  5.0
8.0
## 102 102 664734 335116  112    4    1  OCA    25    34    44 11.0  6.0
6.0
## 103 103 688290 339208  415    3    3   BF    31    35    45 10.4  7.7
10.0
## 104 104 665534 334804  120    4    1   FV    15    18    20 10.0  6.0
6.0
## 105 105 696470 327686  590    2    3  OCA    58    67    70 13.0 12.0
11.0
## 106 106 696707 327780  623    2    3   FV    67    70    73 22.0 13.0
11.0
## 107 107 687072 339485  438    3    3   FF    24    25    43  5.2  5.2
6.4
## 108 108 687081 339375  445    3    3   FV    28    35    44  6.8  4.6
6.6
## 109 109 694702 327706  576    2    3   FF    39    47    57 11.5  9.4
8.3
## 110 110 672639 319381  470    3    3   CF    25    35    45  5.2  4.1
5.7
## 111 111 663925 336421  100    4    1   BF    13    14    28 11.8  2.8
3.7
## 112 112 663836 336451  100    4    1   FV    19    18    33  8.3  5.0
2.8
## 113 113 695429 326084  672    2    3   BF    45    51    58 11.4  9.1
8.9
## 114 114 663914 335632  100    4    1   CF    12    12    24 10.6  4.6
3.0
## 115 115 673011 318201  440    3    3   CF    24    33    41  6.0  5.0
5.0
## 116 116 672834 318268  440    3    3   FV    25    33    38  7.0  5.0
4.0
## 117 117 687110 339519  436    3    3   CF    25    30    42  9.5  5.1
7.6
## 118 118 672980 322650  387    3    3   BF    20    26    37  4.4  4.9
3.0
```

```
## 119 119 666452 337405  134    4    1   BF    21    40    48  5.4  2.6
7.5
## 120 120 695354 326221  630    2    3   CF    43    51    58 11.4  9.0
8.9
## 121 121 692880 341637  575    2    3  MCA    56    59    62 14.0 14.0
12.0
## 122 122 693257 341620  515    2    3   FV    53    59    65 21.0 17.0
3.7
## 123 123 661615 337770  120    4    1  OCA    31    33    40 12.0  6.0
7.0
## 124 124 661824 338087  200    4    1   FV    20    20    25 16.0  7.0
6.0
## 125 125 666630 338621  128    4    1   FV    12    12    16  9.7  2.6
2.1
## 126 126 666687 338874  138    4    1   FV    19    21    34  7.5  3.0
3.0
## 127 127 659456 336935   88    4    1   CF    13    10    33  8.0  2.6
3.9
## 128 128 699567 328185  630    2    3  MCA    17    40    47  8.0  8.0
8.0
## 129 129 699451 328329  660    2    3   FV    39    49    58 10.0  8.0
9.0
## 130 130 673080 323032  360    3    3  MCA    24    31    36  6.0  6.0
6.0
## 131 131 673121 323056  360    3    3   FV    25    35    37  9.0 11.0
6.0
## 132 132 663236 334606  110    4    1  MCA    12    13    27  6.0  4.0
5.0
## 133 133 663100 334323  160    4    1   FV    18    20    25  8.0  2.0
4.0
## 134 134 664648 336318  120    4    1  MCA    10    13    16  9.0  5.0
5.0
## 135 135 665180 335843  167    4    1   FV    15    18    20 10.0  6.0
6.0
## 136 136 698884 328165  608    2    3  MCA    30    43    50  9.0  8.0
9.0
## 137 137 698928 328368  640    2    3   FV    42    61    66  9.0  9.0
8.0
## 138 138 695149 328867  560    2    3  MCA    21    41    47  8.0  8.0
9.0
## 139 139 695014 328757  560    2    3   FV    42    60    66  9.0  8.0
8.0
## 140 140 686356 339523  438    3    3  OCA    19    21    38 15.0 13.0
11.0
## 141 141 686125 339547  450    3    3   FV    33    36    40 13.0 13.0
10.0
## 142 142 695457 328200  553    2    3   FF    45    50    57 10.0  8.3
8.3
## 143 143 695513 328271  546    2    3   FV    36    46    47 13.0 12.0
9.0
```

```
## 144 144 695001 328462  550    2    3   FV    25    38    39  6.0  5.0
5.0
## 145 145 695098 328237  547    2    3  OCA    30    18    23  7.0  6.0
7.0
## 146 146 686534 339916  445    3    3   CF    34    40    45 13.2 12.2
11.7
## 147 147 688608 339579  435    3    3   BF    30    38    46  6.9  4.7
2.9
##        OC1   OC2   OC5
## 1    5.500 3.100 1.500
## 2    3.200 1.700 1.000
## 3    6.980 2.400 1.300
## 4    3.190 1.500 1.260
## 5    4.400 1.200 0.800
## 6    5.310 3.200 1.080
## 7    4.550 2.150 1.225
## 8    4.500 1.420 1.300
## 9    2.300 1.360 0.900
## 10   7.340 2.540 1.700
## 11   5.000 1.940 1.100
## 12   3.850 1.400 0.400
## 13   6.000 1.700 0.800
## 14   3.020 1.200 1.050
## 15   1.950 0.840 0.450
## 16   4.420 3.300 0.740
## 17   2.600 0.900 0.700
## 18   2.820 1.700 1.000
## 19   2.880 1.080 0.725
## 20   1.600 1.000 0.800
## 21   3.700 1.400 0.900
## 22   2.000 0.680 0.500
## 23   4.620 0.700 0.400
## 24   4.320 1.600 1.000
## 25   5.820 1.870 0.900
## 26   2.890 0.950 0.600
## 27   1.040 0.520 0.500
## 28   4.050 1.300 0.500
## 29   4.630 1.300 0.800
## 30   3.860 0.860 0.485
## 31   2.060 0.980 0.700
## 32   5.300 1.700 1.000
## 33   2.500 0.600 0.600
## 34   1.340 0.740 0.600
## 35   3.300 1.180 0.640
## 36   2.080 0.700 0.400
## 37   3.100 0.880 0.560
## 38   1.300 0.340 0.200
## 39   2.210 0.400 0.200
## 40   2.100 0.420 0.370
## 41   1.150 0.400 0.200
```

```
## 42   1.270 0.580 0.500
## 43   4.405 1.106 0.690
## 44   2.208 1.200 0.840
## 45   2.780 1.676 0.950
## 46   1.850 1.130 0.840
## 47   2.300 2.300 0.800
## 48   3.600 1.600 1.100
## 49   3.300 0.750 0.200
## 50   1.420 1.540 0.610
## 51   1.820 1.130 0.820
## 52   1.700 1.500 0.900
## 53   2.000 1.600 0.900
## 54   3.300 1.900 1.200
## 55   1.940 1.140 0.820
## 56   3.710 1.620 1.020
## 57   2.330 1.240 0.920
## 58   4.400 1.500 0.900
## 59   3.800 1.700 0.900
## 60   1.800 1.000 0.700
## 61   2.800 1.800 1.400
## 62   2.800 1.800 1.400
## 63   2.450 0.940 0.520
## 64   1.300 0.300 0.200
## 65   2.450 0.850 0.540
## 66   2.450 0.850 0.540
## 67   3.600 1.640 0.930
## 68   1.240 0.840 0.730
## 69   1.430 1.120 0.950
## 70   2.500 2.200 1.300
## 71   3.100 2.200 1.000
## 72   3.400 1.900 1.000
## 73   1.640 1.110 0.830
## 74   1.450 1.120 0.970
## 75   3.100 2.200 1.000
## 76   3.100 2.200 1.000
## 77   4.400 2.600 1.100
## 78   9.400 3.400 1.250
## 79   4.100 2.800 1.300
## 80   4.200 3.700 1.200
## 81  10.900 1.500 0.900
## 82   2.200 0.600 0.300
## 83   4.400 2.200 1.300
## 84   1.300 0.700 0.600
## 85   1.700 1.300 1.100
## 86   1.640 1.410 1.100
## 87   3.000 2.200 1.100
## 88   3.300 1.700 0.750
## 89   2.500 1.600 1.000
## 90   2.350 0.460 0.280
## 91   1.350 0.630 0.430
```

```
## 92   3.840 1.740 0.910
## 93   4.900 2.100 1.000
## 94   4.410 2.040 0.940
## 95   4.400 1.700 0.900
## 96   2.400 1.530 0.880
## 97   3.400 1.900 1.200
## 98   1.700 1.400 0.900
## 99   3.500 2.100 0.710
## 100  2.130 1.420 1.100
## 101  4.100 1.300 0.900
## 102  2.140 0.960 0.720
## 103  3.700 1.500 0.750
## 104  1.300 0.600 0.400
## 105  3.100 1.500 1.100
## 106  4.800 2.100 1.200
## 107  1.500 0.700 0.450
## 108  3.700 1.600 0.650
## 109  3.000 1.900 0.900
## 110  2.400 1.500 0.800
## 111  2.220 0.450 0.320
## 112  2.600 0.720 0.220
## 113  3.000 1.600 1.100
## 114  2.800 0.900 0.300
## 115  2.300 1.540 1.120
## 116  2.900 1.300 0.800
## 117  3.200 1.100 0.600
## 118  1.700 1.100 0.650
## 119  2.000 0.600 0.400
## 120  3.100 1.600 0.910
## 121  2.800 2.400 1.300
## 122  4.700 3.400 1.400
## 123  2.700 0.780 0.700
## 124  2.500 0.700 0.400
## 125  2.500 0.520 0.250
## 126  2.700 0.620 0.340
## 127  1.800 0.460 0.200
## 128  1.800 0.900 0.800
## 129  2.900 1.200 1.000
## 130  1.600 1.100 0.900
## 131  2.700 2.200 0.900
## 132  1.100 0.330 0.300
## 133  1.300 0.450 0.350
## 134  1.500 0.460 0.290
## 135  1.300 0.600 0.450
## 136  2.100 0.900 0.900
## 137  2.300 1.300 1.000
## 138  1.700 0.900 0.800
## 139  2.300 1.200 1.000
## 140  1.230 0.820 0.740
## 141  2.500 2.200 1.300
```

```
## 142  4.200 1.900 1.100
## 143  3.100 1.400 1.000
## 144  1.500 0.800 0.800
## 145  1.500 0.800 0.800
## 146  3.600 2.000 1.000
## 147  2.700 1.600 0.750
```

```
download.file("https://www.dropbox.com/s/3pi3huovq6qce42/obs.csv?dl=1",
              destfile = "C:/Repositorios.Git/Met_Est_2025")
```

```
## Warning in
##
download.file("https://www.dropbox.com/s/3pi3huovq6qce42/obs.csv?dl=1", :
URL
## https://www.dropbox.com/s/3pi3huovq6qce42/obs.csv?dl=1: cannot open
destfile
## 'C:/Repositorios.Git/Met_Est_2025', reason 'No such file or directory'
```

```
## Warning in
##
download.file("https://www.dropbox.com/s/3pi3huovq6qce42/obs.csv?dl=1", :
## download had nonzero exit status
```

```
suelo <- read.csv("obs.csv")

suelo$zone <- as.factor(suelo$zone)
suelo$wrb1 <- as.factor(suelo$wrb1)

View(suelo)

# Actividad 1 ------------------------------------------------------------
--

# P1
summary(suelo$Clay1)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   10.00   21.00   30.00   31.27   39.00   72.00
```

```
summary(suelo$Clay2)
```

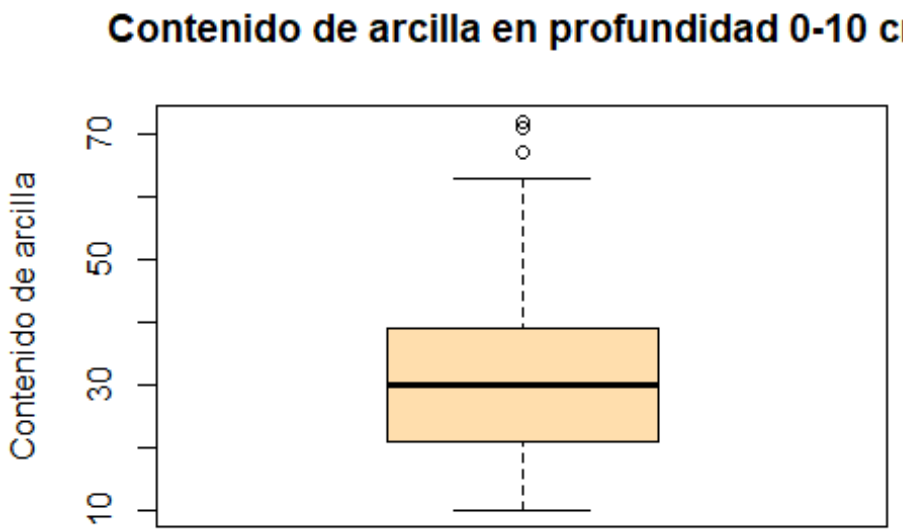
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    8.00   27.00   36.00   36.75   47.00   75.00
```

```
summary(suelo$Clay5)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   16.00   36.50   44.00   44.68   54.00   80.00
```

```
# se observa que el contenido promedio de arcilla conforme aumenta la
profundidad
# es mayor respecto a niveles de profundidad mas superficiales
```

```r
# Actividad 2 ------------------------------------------------------------
--

# Grafica boxplot de clay1
boxplot(suelo$Clay1,
        main = "Contenido de arcilla en profundidad 0-10 cm",
        ylab = "Contenido de arcilla",
        col = "navajowhite")
```




```r
# P2
# Si

# P3
head(suelo$Clay1, 3L) # Primeros 3 valores de Clay1
```

```
## [1] 72 71 61
```

```r
# Actividad 3 ------------------------------------------------------------
--

# Media de la variable Clay1
mean(suelo$Clay1)
```

```
## [1] 31.27211
```

```r
# P4
t.test(suelo$Clay1, mu=30)
```

```
##
##  One Sample t-test
##
## data:  suelo$Clay1
## t = 1.1067, df = 146, p-value = 0.2702
## alternative hypothesis: true mean is not equal to 30
## 95 percent confidence interval:
##  29.00045 33.54377
## sample estimates:
## mean of x
##  31.27211
```

```r
# El contenido de arcilla en suelos tropicales no es significativamente
diferente
# al contenido de arcilla analizado en la prueba experimental TCP

# Actividad 4 ------------------------------------------------------------
--

# P5
shapiro.test(suelo$Clay1)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  suelo$Clay1
## W = 0.95508, p-value = 0.0001053
```

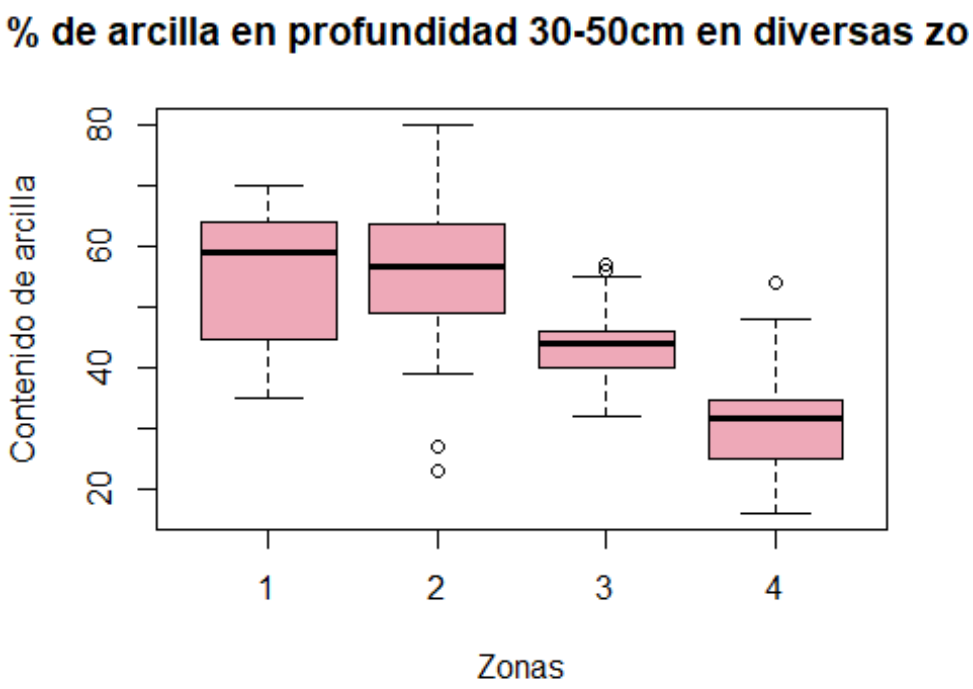
```r
shapiro.test(suelo$Clay5)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  suelo$Clay5
## W = 0.99077, p-value = 0.4509
```

```r
# Datos no normales

cor.test(suelo$Clay1, suelo$Clay5,
         method = "spearman")
```

```
## Warning in cor.test.default(suelo$Clay1, suelo$Clay5, method =
"spearman"):
## Cannot compute exact p-value with ties

##
##  Spearman's rank correlation rho
##
```

```
## data:  suelo$Clay1 and suelo$Clay5
## S = 58999, p-value < 2.2e-16
## alternative hypothesis: true rho is not equal to 0
## sample estimates:
##       rho
## 0.8885543

# Existe una correlacion positiva fuerte entre los contenidos de arcilla
# con respecto a los perfiles superiores e inferiores

# P7
# La relacion es estadisticamente significativa

# Actividad 5 ------------------------------------------------------------
--

# P6
# Si, podrian identificarse de manera visual por medio de graficos de
bigotes
# (boxplot), y observando sus variaciones por medio de pruebas
estadisticas
# para encontrar similitudes entre concentracion de arcilla por zonas.
# Como medias, sd, varianzas, correlacion, etc.

# P7
plot(suelo$zone, suelo$Clay5,
        main = "% de arcilla en profundidad 30-50cm en diversas zonas",
        col = "pink2",
     xlab = "Zonas",
     ylab = "Contenido de arcilla")
```




```
# Si, existen indicios. se puede observar como el contenido de arcilla es
mayor
# en las zonas 1 y 2, y menor en las zonas 3 y 4
```