Assignment Unit Root Test - Solution

From the data set assign_timeseries:

1. Test whether the series set50 and set50future are stationary series and determine their integrated order.

```
. dfuller set50, trend lag(2) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =      7681

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -2.316            -3.960            -3.410            -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.4252

------------------------------------------------------------------------------
D.set50      |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       set50 |
         L1. |  -.0014134   .0006103    -2.32   0.021    -.0026098    -.000217
         LD. |   .0461723   .0113989     4.05   0.000     .0238274    .0685172
        L2D. |  -.0501139   .0113993    -4.40   0.000    -.0724595   -.0277682
      _trend |   .0000163   8.32e-06     1.96   0.050    -2.58e-08    .0000326
       _cons |   .7078793   .3026486     2.34   0.019     .1146054    1.301153
------------------------------------------------------------------------------

. dfuller d.set50, trend lag(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =      7681

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -63.765            -3.960            -3.410            -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D2.set50     |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     D.set50 |
         L1. |  -1.005364   .0157667   -63.77   0.000    -1.036271    -.974457
         LD. |   .0508571    .011398     4.46   0.000     .0285139    .0732003
      _trend |   7.82e-07   4.94e-06     0.16   0.874    -8.90e-06    .0000105
       _cons |   .0088178   .0219189     0.40   0.687    -.0341492    .0517848
------------------------------------------------------------------------------

. dfuller set50future, trend lag(2) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =      7681

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -2.467            -3.960            -3.410            -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.3445

------------------------------------------------------------------------------
D.set50fut~e |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 set50future |
         L1. |  -.0017017   .0006897    -2.47   0.014    -.0030538   -.0003497
         LD. |  -.0287049   .0114066    -2.52   0.012     -.051065   -.0063448
        L2D. |  -.0371762   .0114057    -3.26   0.001    -.0595345    -.014818
      _trend |   .0000215   1.00e-05     2.15   0.032     1.88e-06    .0000411
       _cons |   .8310111   .3338262     2.49   0.013     .1766205    1.485402
------------------------------------------------------------------------------

. dfuller d.set50future, trend lag(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =      7681

                               ---------- Interpolated Dickey-Fuller ---------
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By Tatre Jantarakolica

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                 Test         1% Critical       5% Critical      10% Critical
              Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)           -65.269            -3.960            -3.410            -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D2.set50fu~e |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
D.set50fut~e |
         L1. |  -1.067592   .0163567   -65.27   0.000    -1.099655   -1.035528
         LD. |    .038008   .0114045     3.33   0.001     .0156522    .0603639
      _trend |   1.01e-06   5.59e-06     0.18   0.856    -9.94e-06     .000012
       _cons |   .0096235   .0247823     0.39   0.698    -.0389566    .0582036
------------------------------------------------------------------------------
```

set50 and set50future are both nonstationary but they are I(1).

2. From set50 and set50future, generate spot return (spot) and future return (future) and test whether they are stationary.

```
. g spot =((set50/l.set50)-1)*100
(4 missing values generated)

. g future =((set50future/l.set50future)-1)*100
(4 missing values generated)


. dfuller spot, trend lag(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =      7681

                               ---------- Interpolated Dickey-Fuller ---------
                 Test         1% Critical       5% Critical      10% Critical
              Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)           -63.787            -3.960            -3.410            -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D.spot       |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        spot |
         L1. |  -1.005168   .0157581   -63.79   0.000    -1.036058   -.9742776
         LD. |   .0517018   .0113974     4.54   0.000     .0293598    .0740439
      _trend |   9.56e-08   9.19e-07     0.10   0.917    -1.71e-06    1.90e-06
       _cons |   .0019863   .0040765     0.49   0.626    -.0060048    .0099774
------------------------------------------------------------------------------

. dfuller spot, lag(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =      7681

                               ---------- Interpolated Dickey-Fuller ---------
                 Test         1% Critical       5% Critical      10% Critical
              Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)           -63.791            -3.430            -2.860            -2.570
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
      D.spot |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        spot |
         L1. |  -1.005165   .0157571   -63.79   0.000    -1.036053   -.9742771
         LD. |   .0517007   .0113967     4.54   0.000     .0293601    .0740413
             |
       _cons |   .0023535   .0020378     1.15   0.248    -.0016411    .0063482
------------------------------------------------------------------------------

. dfuller future, trend lag(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =      7681

                               ---------- Interpolated Dickey-Fuller ---------
                 Test         1% Critical       5% Critical      10% Critical
              Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)           -65.070            -3.960            -3.410            -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000
```

```
------------------------------------------------------------------------------
D.future     |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      future |
         L1. |  -1.063572   .0163449   -65.07   0.000    -1.095612   -1.031531
         LD. |     .03575   .0114053     3.13   0.002     .0133924    .0581076
      _trend |   1.17e-07   1.06e-06     0.11   0.912    -1.96e-06    2.19e-06
       _cons |   .0023077    .004702     0.49   0.624    -.0069096    .0115249
------------------------------------------------------------------------------

. dfuller future, lag(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =      7681

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -65.074            -3.430            -2.860            -2.570
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
    D.future |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      future |
         L1. |  -1.063569   .0163439   -65.07   0.000    -1.095608   -1.031531
         LD. |   .0357488   .0114046     3.13   0.002     .0133927    .0581049
             |
       _cons |   .0027569   .0023505     1.17   0.241    -.0018507    .0073645
------------------------------------------------------------------------------
```

Both series are stationary.