Strategy Design (ML Fin Data - Project 1)

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Libraries

0. Scraping the SP500

In order to test the logic within the strategy, I have fetched functions that retrieve a number of sample stocks by sector from the SP500.

```
# to obtain relative paths
library(here)

# Load code into environment
source(here("functions", "fetch_sp500_sectors.R"))
```

```
## Getting holdings for SP500
```

0.0.1 SP500 Economic Sectors

The following function fetches and extract the economic sectors from the SP500, taken from Wikipedia.

```
# fetch the sectors as a dataframe
sp500_sectors <- f_get_sp500_sectors()
head(sp500_sectors)
```

```
##   tickers               sectors
## 1     MMM            Industrials
## 2     AOS            Industrials
## 3     ABT            Health Care
## 4    ABBV            Health Care
## 5     ACN Information Technology
## 6    ATVI Communication Services
```

0.0.2 SP500 Sector Weight

```
# wrap into a single argument funciton
fetch_sp500_sector_data <- function(x){f_fetch_sector_data(x, sp500, sp500_sectors)}

# call the function
head(fetch_sp500_sector_data("Information Technology"))
```

```
##   ticker                sector       weight shares_held
## 1   AAPL Information Technology 0.0698409265   165611795
## 2    ACN Information Technology 0.0053975294     7109528
## 3   ADBE Information Technology 0.0062945771     5137212
## 4    ADI Information Technology 0.0023744382     5651306
## 5   ADSK Information Technology 0.0011865324     2408799
## 6   AKAM Information Technology 0.0004432907     1719989
```

0.0.3 Retrieving top sectors and stocks

Pack everything into one function to retrieve all the data

```
# Retrieve top 10 stocks by weight for each sector in the top 5 sectors from the SP500 (by weight)
sector_list <- f_retrieve_top_sp500(top_n_sectors = 6, top_n_stocks = 15, only_tickers=TRUE)
```

```
## Getting holdings for SP500
```

```
sector_list
```

```
## $Industrials
##  [1] "ADP" "BA"  "CAT" "CSX" "DE"  "ETN" "FDX" "GE"  "HON" "ITW" "LMT" "NOC"
## [13] "RTX" "UNP" "UPS"
##
## $`Health Care`
##  [1] "ABBV" "ABT"  "AMGN" "BMY"  "DHR"  "ELV"  "ISRG" "JNJ"  "LLY"  "MDT"
## [11] "MRK"  "PFE"  "SYK"  "TMO"  "UNH"
##
## $`Information Technology`
##  [1] "AAPL" "ACN"  "ADBE" "AMD"  "AVGO" "CRM"  "CSCO" "IBM"  "INTC" "INTU"
## [11] "MSFT" "NVDA" "ORCL" "QCOM" "TXN"
##
## $`Communication Services`
##  [1] "ATVI"  "CHTR"  "CMCSA" "DIS"   "EA"    "GOOG"  "GOOGL" "META"  "NFLX"
## [10] "OMC"   "T"     "TMUS"  "TTWO"  "VZ"    "WBD"
##
## $Financials
##  [1] "AXP"  "BAC"  "BLK"  "C"    "CB"   "GS"   "JPM"  "MA"   "MMC"  "MS"
## [11] "PGR"  "SCHW" "SPGI" "V"    "WFC"
##
## $`Consumer Discretionary`
##  [1] "ABNB" "AMZN" "AZO"  "BKNG" "CMG"  "F"    "GM"   "HD"   "MAR"  "MCD"
## [11] "NKE"  "ORLY" "SBUX" "TJX"  "TSLA"
```

This logic is implemented under **functions/fetch_sp500_sectors.R**

0.0.4 Retrieving top sectors and stocks

```
# function to fetch all the information for one ticker into a nice xts dataframe
sp500_stocks <- lapply(sector_list,
                       f_fetch_all_tickers,
                       start_date="2018-01-01",
                       end_date="2022-12-01")

# update format so that it becomes a named list of lists
sp500_stocks <- lapply(sp500_stocks, function(sector_l){
  setNames(sector_l$stock_data, sector_l$tickers)
  }
)
```

```
# Show the available sectors
names(sp500_stocks)
```

```
## [1] "Industrials"            "Health Care"            "Information Technology"
## [4] "Communication Services" "Financials"             "Consumer Discretionary"
```

```
# Show available stocks for Industrials
names(sp500_stocks$Industrials)
```

```
##  [1] "ADP" "BA"  "CAT" "CSX" "DE"  "ETN" "FDX" "GE"  "HON" "ITW" "LMT" "NOC"
## [13] "RTX" "UNP" "UPS"
```

```
# access the xts of the stocks in industrials
head(sp500_stocks$Industrials$ADP)
```

```
##            direction_lead adp_adjclose_lead adp_adjclose_lag0 adp_adjclose_lag1
## 2018-01-03             NA       0.003405753                NA                NA
## 2018-01-10             NA       0.036716592       0.003405753                NA
## 2018-01-17             NA      -0.009797733       0.036716592       0.003405753
## 2018-01-24             NA       0.022660225      -0.009797733       0.036716592
## 2018-01-31             NA      -0.084961691       0.022660225      -0.009797733
## 2018-02-07             NA      -0.007513138      -0.084961691       0.022660225
##            adp_adjclose_lag2 adp_adjclose_lag3 atr adx aaron bb chaikin_vol clv
## 2018-01-03                NA                NA  NA  NA    NA NA          NA  NA
## 2018-01-10                NA                NA  NA  NA    50 NA          NA  NA
## 2018-01-17                NA                NA  NA  NA   100 NA          NA  NA
## 2018-01-24       0.003405753                NA  NA  NA   100 NA          NA  NA
## 2018-01-31       0.036716592       0.003405753  NA  NA   100 NA          NA  NA
## 2018-02-07      -0.009797733       0.036716592  NA  NA   -50 NA          NA  NA
##            emv macd mfi      sar smi volat month_index
## 2018-01-03  NA   NA  NA 115.3586  NA    NA           1
## 2018-01-10  NA   NA  NA 115.4054  NA    NA           1
## 2018-01-17  NA   NA  NA 115.5252  NA    NA           1
## 2018-01-24  NA   NA  NA 115.9245  NA    NA           1
## 2018-01-31  NA   NA  NA 116.4665  NA    NA           1
## 2018-02-07  NA   NA  NA 125.2400  NA    NA           2
```

1. Backtesting Logic

Adding a numeric index

First, we need to create a corresponding index for each week:

```
# count number of weeks in data from one of the dataframes
sample_xts <- sp500_stocks$Industrials$ADP
head(sample_xts, 10)
```

```
##            direction_lead adp_adjclose_lead adp_adjclose_lag0 adp_adjclose_lag1
## 2018-01-03             NA       0.003405753                NA                NA
## 2018-01-10             NA       0.036716592       0.003405753                NA
## 2018-01-17             NA      -0.009797733       0.036716592       0.003405753
## 2018-01-24             NA       0.022660225      -0.009797733       0.036716592
## 2018-01-31             NA      -0.084961691       0.022660225      -0.009797733
## 2018-02-07             NA      -0.007513138      -0.084961691       0.022660225
## 2018-02-14             NA       0.029633427      -0.007513138      -0.084961691
## 2018-02-21             NA      -0.006740983       0.029633427      -0.007513138
## 2018-02-28             NA      -0.001214584      -0.006740983       0.029633427
## 2018-03-07             NA       0.013440308      -0.001214584      -0.006740983
##            adp_adjclose_lag2 adp_adjclose_lag3 atr adx aaron bb chaikin_vol
## 2018-01-03                NA                NA  NA  NA    NA NA          NA
## 2018-01-10                NA                NA  NA  NA    50 NA          NA
## 2018-01-17                NA                NA  NA  NA   100 NA          NA
```

```
## 2018-01-24       0.003405753                NA  NA  NA   100 NA          NA
## 2018-01-31       0.036716592       0.003405753  NA  NA   100 NA          NA
## 2018-02-07      -0.009797733       0.036716592  NA  NA   -50 NA          NA
## 2018-02-14       0.022660225      -0.009797733  NA  NA  -100 NA          NA
## 2018-02-21      -0.084961691       0.022660225  NA  NA    50 NA          NA
## 2018-02-28      -0.007513138      -0.084961691  NA  NA    50 NA          NA
## 2018-03-07       0.029633427      -0.007513138  NA  NA  -100 NA          NA
##                    clv          emv macd mfi      sar smi      volat month_index
## 2018-01-03          NA           NA   NA  NA 115.3586  NA         NA           1
## 2018-01-10          NA           NA   NA  NA 115.4054  NA         NA           1
## 2018-01-17          NA           NA   NA  NA 115.5252  NA         NA           1
## 2018-01-24          NA           NA   NA  NA 115.9245  NA         NA           1
## 2018-01-31          NA           NA   NA  NA 116.4665  NA         NA           1
## 2018-02-07          NA           NA   NA  NA 125.2400  NA         NA           2
## 2018-02-14          NA           NA   NA  NA 125.2400  NA         NA           2
## 2018-02-21          NA           NA   NA  NA 124.7388  NA         NA           2
## 2018-02-28          NA           NA   NA  NA 124.2576  NA         NA           2
## 2018-03-07 0.09611807 -0.005879919   NA  NA 123.7957  NA 0.2378317           3
```

```r
# month index are assigned automatically
sample_xts[, c( "month_index")]
```

```
##            month_index
## 2018-01-03           1
## 2018-01-10           1
## 2018-01-17           1
## 2018-01-24           1
## 2018-01-31           1
## 2018-02-07           2
## 2018-02-14           2
## 2018-02-21           2
## 2018-02-28           2
## 2018-03-07           3
##        ...
## 2022-09-28          57
## 2022-10-05          58
## 2022-10-12          58
## 2022-10-19          58
## 2022-10-26          58
## 2022-11-02          59
## 2022-11-09          59
## 2022-11-16          59
## 2022-11-23          59
## 2022-11-30          59
```

splitting data by week

Initially, the idea was to split week-by-week, however, since we have to rebalance everymonth, this might lead to inconsistent results. Therefore, here I'm splitting the data week by week:

```r
library(xts)

# spli by months
sample_xts_by_month <- split.xts(sample_xts, f= "months")
names(sample_xts_by_month)
```

```
##  [1] "Jan 2018" "Feb 2018" "Mar 2018" "Apr 2018" "May 2018" "Jun 2018"
##  [7] "Jul 2018" "Aug 2018" "Sep 2018" "Oct 2018" "Nov 2018" "Dec 2018"
```

```
## [13] "Jan 2019" "Feb 2019" "Mar 2019" "Apr 2019" "May 2019" "Jun 2019"
## [19] "Jul 2019" "Aug 2019" "Sep 2019" "Oct 2019" "Nov 2019" "Dec 2019"
## [25] "Jan 2020" "Feb 2020" "Mar 2020" "Apr 2020" "May 2020" "Jun 2020"
## [31] "Jul 2020" "Aug 2020" "Sep 2020" "Oct 2020" "Nov 2020" "Dec 2020"
## [37] "Jan 2021" "Feb 2021" "Mar 2021" "Apr 2021" "May 2021" "Jun 2021"
## [43] "Jul 2021" "Aug 2021" "Sep 2021" "Oct 2021" "Nov 2021" "Dec 2021"
## [49] "Jan 2022" "Feb 2022" "Mar 2022" "Apr 2022" "May 2022" "Jun 2022"
## [55] "Jul 2022" "Aug 2022" "Sep 2022" "Oct 2022" "Nov 2022"
```

```r
length(names(sample_xts_by_month)) # total number of months of data
```

```
## [1] 59
```

BACKTESTING_PROCEDURE

1. Assume we have N_{years} years of weekly data, giving a total of N_{months} many months. 2. We want to fix a window of $N_W = 12$ months at the time (i.e. a year of data).
2. The total number of runs is given by

$$N^{runs} = \left\lfloor \frac{N_{months} - N_W}{s} \right\rfloor$$

, where $s = 1$ is the number of months to move at the time (because of monthly rebalance).

In our case, this gives

$$N^{runs} = \left\lfloor \frac{59 - 12}{1} \right\rfloor = 47$$

i.e., we can move 47 times when predicting one week at the time, starting with having all the data until month 12.

```r
# Set up backtesting simulation parameters
sample_xts <- sp500_stocks$Industrials$ADP
sectors <- names(sp500_stocks)
N_sector_stocks <- 3 #

# Formula parameters
slide <- 1
N_months <- length(names(split.xts(sample_xts, f= "months")))
N_window <- 12 # number of months in size for each window
N_runs <- floor((N_months - N_window)/slide)

# setup initial portfolio tracking variables
initial_capital <- 500000
num_tickers <- length(sectors)*N_sector_stocks
initial_tickers <- rep(NA, num_tickers)
weights <- rep(1/num_tickers, num_tickers) # initialize to 1/n
returns <- rep(NA, N_runs)

# repack the portfolio
portfolio <- list(tickers = initial_tickers,
                  weights = weights,
                  capital = initial_capital,
                  returns = returns
                  )
portfolio
```

```
## $tickers
##  [1] NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA
##
## $weights
##  [1] 0.05555556 0.05555556 0.05555556 0.05555556 0.05555556 0.05555556
##  [7] 0.05555556 0.05555556 0.05555556 0.05555556 0.05555556 0.05555556
## [13] 0.05555556 0.05555556 0.05555556 0.05555556 0.05555556 0.05555556
##
## $capital
## [1] 5e+05
##
## $returns
##  [1] NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA
## [26] NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA
```

```
print(paste(rep("-", 100), collapse = ""))
```

```
## [1] "----------------------------------------------------------------------------------------------------"
```

```
# Initiate backtesting
print("BACKTESTING")
```

```
## [1] "BACKTESTING"
```

```
print("")
```

```
## [1] ""
```

```
# for every run (sliding window of time to consider)
for(tau in seq(N_runs)){
  # close any positions
  print(paste0("(tau=", tau, ") CLOSE all positions."))

  # Calculate and record profit-loss
  print("(1) COMPUTE_P/L(portfolio)")
  portfolio$capital <- portfolio$capital * (1 + runif(1, -0.05, 0.10))
  print(paste0("--> Capital:", portfolio$capital, "$"))

  # keep index counter for sectors
  i_sector <- 1

  # current portf
  cur_tickers <- rep(NA, num_tickers)

  print("")
  print("(2) PORTFOLIO_LOOP:")
  # loop through all the sectors
  for(G in sectors){
    # execute sector procedure
    print(paste0("    SECTOR_PROCEDURE(G=", G, ", tau=",tau, ")"))

    # return top 3 best stocks according to procedure
    top_sector_stocks <- sample(names(sp500_stocks[[G]]), 3 )

    # assign best stocks to portfolio (NEED TO UPDATE LOGIC!)
    i_replace <- c(i_sector, i_sector+1, i_sector+2)
    cur_tickers[i_replace] <- top_sector_stocks
```

```
    i_sector <- i_sector + 3
  }

  # Assign tickers for this simulation
  portfolio$tickers <- as.vector(cur_tickers)

  # Display selected portfolio tickers
  print("Cur Portfolio:")
  print(portfolio$tickers)

  # Optimize portfolio weights using modified min_variance
  print("")
  print("(3) OPTIMIZE_PORTFOLIO(portfolio)")
  print("weights: ")
  print(paste(" ", portfolio$weights))
  print("")
  print("(4) LONG PORTFOLIO()")


  # Separate similuation (over)
  print(paste(rep("-", 100), collapse = ""))
}
```

```
## [1] "(tau=1) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:528854.229691206$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=1)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=1)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=1)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=1)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=1)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=1)"
## [1] "Cur Portfolio:"
##  [1] "LMT"  "NOC"  "UPS"  "BMY"  "ABBV" "UNH"  "AAPL" "INTU" "NVDA" "OMC"
## [11] "EA"   "T"    "MS"   "V"    "BAC"  "AZO"  "AMZN" "MAR"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "----------------------------------------------------------------------------------------------------"
## [1] "(tau=2) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:552753.620083455$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=2)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=2)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=2)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=2)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=2)"
```

```
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=2)"
## [1] "Cur Portfolio:"
##  [1] "RTX"  "ETN"  "HON"  "UNH"  "ABBV" "AMGN" "ADBE" "NVDA" "QCOM" "GOOG"
## [11] "OMC"  "TMUS" "AXP"  "CB"   "V"    "CMG"  "TSLA" "HD"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=3) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:566206.024094006$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=3)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=3)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=3)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=3)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=3)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=3)"
## [1] "Cur Portfolio:"
##  [1] "UNP"   "BA"    "UPS"   "MRK"   "ELV"   "TMO"   "INTU"  "AVGO"  "ACN"
## [10] "GOOGL" "META"  "CMCSA" "SCHW"  "WFC"   "C"     "SBUX"  "NKE"   "AMZN"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=4) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:622348.278861951$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=4)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=4)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=4)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=4)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=4)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=4)"
## [1] "Cur Portfolio:"
##  [1] "CAT"  "ETN"  "NOC"  "AMGN" "ISRG" "UNH"  "IBM"  "INTC" "MSFT" "META"
## [11] "GOOG" "CHTR" "GS"   "MA"   "MMC"  "MCD"  "AZO"  "MAR"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
```

```
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=5) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:653784.762728087$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=5)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=5)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=5)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=5)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=5)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=5)"
## [1] "Cur Portfolio:"
##  [1] "GE"    "ETN"   "CAT"   "JNJ"   "DHR"   "ABBV"  "CSCO"  "TXN"   "NVDA"
## [10] "CHTR"  "TTWO"  "GOOGL" "MS"    "C"     "GS"    "AZO"   "ORLY"  "AMZN"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=6) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:701523.79045431$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=6)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=6)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=6)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=6)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=6)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=6)"
## [1] "Cur Portfolio:"
##  [1] "ETN"   "GE"    "CSX"   "MRK"   "ELV"   "MDT"   "IBM"   "TXN"   "ACN"
## [10] "GOOGL" "DIS"   "CMCSA" "C"     "GS"    "MMC"   "MAR"   "TJX"   "MCD"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
```

```
## [1] "(tau=7) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:667824.270912271$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=7)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=7)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=7)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=7)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=7)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=7)"
## [1] "Cur Portfolio:"
##  [1] "HON"  "ITW"  "UNP"  "SYK"  "ABBV" "DHR"  "INTC" "INTU" "CSCO" "CHTR"
## [11] "META" "OMC"  "AXP"  "MS"   "V"    "TJX"  "CMG"  "MAR"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=8) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:676066.470800228$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=8)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=8)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=8)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=8)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=8)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=8)"
## [1] "Cur Portfolio:"
##  [1] "UPS"  "NOC"  "CSX"  "UNH"  "PFE"  "LLY"  "AVGO" "INTU" "ACN"  "WBD"
## [11] "META" "EA"   "JPM"  "GS"   "PGR"  "GM"   "SBUX" "NKE"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=9) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:684541.977465045$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=9)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=9)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=9)"
```

```
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=9)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=9)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=9)"
## [1] "Cur Portfolio:"
##  [1] "DE"   "CAT"  "FDX"  "ABBV" "BMY"  "DHR"  "IBM"  "ADBE" "TXN"  "OMC"
## [11] "TMUS" "ATVI" "BAC"  "GS"   "CB"   "SBUX" "BKNG" "HD"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=10) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:722961.495312772$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=10)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=10)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=10)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=10)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=10)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=10)"
## [1] "Cur Portfolio:"
##  [1] "BA"   "FDX"  "ETN"  "UNH"  "ELV"  "SYK"  "AMD"  "ORCL" "MSFT" "WBD"
## [11] "VZ"   "META" "V"    "WFC"  "MMC"  "ORLY" "AZO"  "SBUX"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=11) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:695139.854491534$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=11)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=11)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=11)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=11)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=11)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=11)"
## [1] "Cur Portfolio:"
##  [1] "GE"    "ADP"   "DE"    "SYK"   "JNJ"   "ISRG"  "ADBE"  "TXN"   "NVDA"
## [10] "OMC"   "NFLX"  "GOOGL" "C"     "GS"    "JPM"   "CMG"   "ORLY"  "F"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
```

```
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=12) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:673776.293140269$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=12)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=12)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=12)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=12)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=12)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=12)"
## [1] "Cur Portfolio:"
##  [1] "GE"   "ITW"  "LMT"  "ISRG" "JNJ"  "ELV"  "ACN"  "MSFT" "IBM"  "VZ"
## [11] "CHTR" "T"    "MMC"  "MA"   "C"    "MCD"  "TSLA" "TJX"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=13) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:656803.929691552$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=13)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=13)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=13)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=13)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=13)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=13)"
## [1] "Cur Portfolio:"
##  [1] "ETN"  "CAT"  "CSX"  "BMY"  "TMO"  "PFE"  "IBM"  "QCOM" "INTU" "ATVI"
## [11] "GOOG" "EA"   "C"    "MA"   "CB"   "HD"   "MCD"  "GM"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
```

```
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=14) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:656979.051766538$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=14)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=14)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=14)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=14)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=14)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=14)"
## [1] "Cur Portfolio:"
##  [1] "HON"  "ITW"  "DE"   "ELV"  "SYK"  "AMGN" "ORCL" "AAPL" "TXN"  "CHTR"
## [11] "T"    "TTWO" "PGR"  "MA"   "C"    "AZO"  "BKNG" "TSLA"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=15) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:719663.410183801$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=15)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=15)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=15)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=15)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=15)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=15)"
## [1] "Cur Portfolio:"
##  [1] "UPS"  "GE"   "NOC"  "MDT"  "PFE"  "ISRG" "AMD"  "AAPL" "CSCO" "GOOG"
## [11] "OMC"  "DIS"  "MS"   "MA"   "PGR"  "CMG"  "GM"   "MAR"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=16) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:696921.382266233$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=16)"
```

```
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=16)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=16)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=16)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=16)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=16)"
## [1] "Cur Portfolio:"
##  [1] "CAT"   "GE"    "DE"    "MDT"   "ISRG"  "SYK"   "ACN"   "NVDA"  "INTU"
## [10] "GOOGL" "VZ"    "NFLX"  "C"     "MMC"   "WFC"   "BKNG"  "GM"    "TSLA"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=17) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:677119.0019586$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=17)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=17)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=17)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=17)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=17)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=17)"
## [1] "Cur Portfolio:"
##  [1] "ETN"  "ADP"  "RTX"  "ISRG" "MDT"  "LLY"  "MSFT" "AMD"  "ACN"  "META"
## [11] "DIS"  "WBD"  "AXP"  "C"    "BAC"  "MCD"  "CMG"  "GM"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=18) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:689904.386494001$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=18)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=18)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=18)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=18)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=18)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=18)"
## [1] "Cur Portfolio:"
##  [1] "ITW"  "DE"   "LMT"  "JNJ"  "MDT"  "DHR"  "CRM"  "AAPL" "ADBE" "VZ"
## [11] "WBD"  "OMC"  "MMC"  "CB"   "V"    "MCD"  "TSLA" "AMZN"
```

```
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=19) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:725268.916669837$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=19)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=19)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=19)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=19)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=19)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=19)"
## [1] "Cur Portfolio:"
##  [1] "LMT"   "BA"    "HON"   "BMY"   "LLY"   "DHR"   "MSFT"  "INTU"  "ACN"
## [10] "EA"    "TMUS"  "CMCSA" "V"     "MA"    "PGR"   "AZO"   "ABNB"  "BKNG"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=20) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:705688.98681029$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=20)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=20)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=20)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=20)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=20)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=20)"
## [1] "Cur Portfolio:"
##  [1] "UNP"  "ITW"  "RTX"  "UNH"  "BMY"  "ELV"  "AAPL" "TXN"  "CSCO" "CHTR"
## [11] "EA"   "VZ"   "MS"   "V"    "GS"   "F"    "ABNB" "MAR"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
```

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## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=21) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:757802.181053775$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=21)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=21)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=21)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=21)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=21)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=21)"
## [1] "Cur Portfolio:"
##  [1] "FDX"   "LMT"   "ITW"   "ABT"   "MRK"   "DHR"   "CSCO"  "NVDA"  "ORCL"
## [10] "NFLX"  "GOOGL" "ATVI"  "WFC"   "PGR"   "V"     "GM"    "CMG"   "ORLY"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=22) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:809511.97170792$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=22)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=22)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=22)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=22)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=22)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=22)"
## [1] "Cur Portfolio:"
##  [1] "ETN"   "LMT"   "CSX"   "PFE"   "MDT"   "ISRG"  "IBM"   "INTU"  "MSFT"
## [10] "GOOGL" "CHTR"  "CMCSA" "PGR"   "CB"    "MA"    "GM"    "BKNG"  "TSLA"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=23) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:818314.659617596$"
## [1] ""
```

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## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=23)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=23)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=23)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=23)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=23)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=23)"
## [1] "Cur Portfolio:"
##  [1] "RTX"   "DE"    "NOC"   "UNH"   "PFE"   "MRK"   "ORCL"  "AMD"   "INTU"
## [10] "NFLX"  "DIS"   "GOOGL" "BAC"   "C"     "SPGI"  "TSLA"  "HD"    "CMG"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=24) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:883248.348662366$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=24)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=24)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=24)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=24)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=24)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=24)"
## [1] "Cur Portfolio:"
##  [1] "HON"  "FDX"  "DE"   "ELV"  "ABT"  "UNH"  "INTU" "INTC" "QCOM" "EA"
## [11] "TMUS" "TTWO" "GS"   "SCHW" "BLK"  "AZO"  "TSLA" "AMZN"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=25) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:903791.817184012$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=25)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=25)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=25)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=25)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=25)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=25)"
## [1] "Cur Portfolio:"
```

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##  [1] "NOC"  "ETN"  "DE"   "ELV"  "TMO"  "UNH"  "AVGO" "CSCO" "ACN"  "ATVI"
## [11] "TMUS" "T"    "CB"   "SCHW" "BLK"  "HD"   "NKE"  "CMG"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=26) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:915050.733254508$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=26)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=26)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=26)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=26)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=26)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=26)"
## [1] "Cur Portfolio:"
##  [1] "HON"  "NOC"  "BA"   "ISRG" "BMY"  "SYK"  "INTU" "AAPL" "IBM"  "CHTR"
## [11] "WBD"  "VZ"   "C"    "BAC"  "SPGI" "BKNG" "TSLA" "SBUX"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=27) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:999473.584282504$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=27)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=27)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=27)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=27)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=27)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=27)"
## [1] "Cur Portfolio:"
##  [1] "FDX"   "CAT"   "LMT"   "LLY"   "ELV"   "SYK"   "MSFT"  "IBM"   "INTC"
## [10] "GOOG"  "TMUS"  "CMCSA" "V"     "C"     "SCHW"  "CMG"   "F"     "AZO"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
```

```
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=28) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1013007.3925335$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=28)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=28)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=28)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=28)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=28)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=28)"
## [1] "Cur Portfolio:"
##  [1] "ADP"   "HON"   "UNP"   "AMGN"  "ELV"   "MRK"   "AVGO"  "QCOM"  "ORCL"
## [10] "TMUS"  "NFLX"  "CMCSA" "SPGI"  "C"     "V"     "CMG"   "MAR"   "BKNG"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=29) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1033232.41038356$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=29)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=29)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=29)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=29)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=29)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=29)"
## [1] "Cur Portfolio:"
##  [1] "UNP"  "CSX"  "BA"   "ABT"  "AMGN" "LLY"  "AAPL" "NVDA" "TXN"  "WBD"
## [11] "OMC"  "ATVI" "BAC"  "GS"   "WFC"  "HD"   "MAR"  "SBUX"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=30) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
```

```
## [1] "--> Capital:1034253.84604166$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=30)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=30)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=30)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=30)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=30)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=30)"
## [1] "Cur Portfolio:"
##  [1] "UPS"   "FDX"   "GE"    "ISRG"  "ABBV"  "TMO"   "INTU"  "CSCO"  "QCOM"
## [10] "WBD"   "GOOG"  "GOOGL" "SPGI"  "JPM"   "MS"    "NKE"   "ORLY"  "GM"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=31) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1012891.1580383$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=31)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=31)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=31)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=31)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=31)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=31)"
## [1] "Cur Portfolio:"
##  [1] "DE"    "NOC"   "RTX"   "TMO"   "ABT"   "JNJ"   "ADBE"  "CRM"   "AMD"
## [10] "GOOGL" "CHTR"  "WBD"   "WFC"   "SPGI"  "MMC"   "SBUX"  "AZO"   "F"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=32) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1000669.66719973$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=32)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=32)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=32)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=32)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=32)"
```

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## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=32)"
## [1] "Cur Portfolio:"
##  [1] "UNP"   "HON"   "CSX"   "UNH"   "ABT"   "ELV"   "ACN"   "CSCO"  "AVGO"
## [10] "TMUS"  "TTWO"  "GOOGL" "SCHW"  "AXP"   "V"     "SBUX"  "AMZN"  "BKNG"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=33) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:986836.772468763$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=33)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=33)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=33)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=33)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=33)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=33)"
## [1] "Cur Portfolio:"
##  [1] "ADP"   "CAT"   "RTX"   "MDT"   "ISRG"  "PFE"   "INTC"  "CSCO"  "TXN"
## [10] "WBD"   "CMCSA" "GOOGL" "WFC"   "MS"    "SCHW"  "MCD"   "AMZN"  "AZO"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=34) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:996928.039836049$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=34)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=34)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=34)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=34)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=34)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=34)"
## [1] "Cur Portfolio:"
##  [1] "ADP"  "CAT"  "LMT"  "MDT"  "ELV"  "ISRG" "INTU" "CRM"  "ORCL" "WBD"
## [11] "GOOG" "META" "MS"   "SPGI" "BLK"  "CMG"  "AMZN" "TJX"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
```

```
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=35) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1093930.2363311$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=35)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=35)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=35)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=35)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=35)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=35)"
## [1] "Cur Portfolio:"
##  [1] "BA"   "UNP"  "ITW"  "DHR"  "LLY"  "ABT"  "INTU" "INTC" "AVGO" "WBD"
## [11] "META" "EA"   "BLK"  "MMC"  "WFC"  "AMZN" "NKE"  "TSLA"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=36) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1104200.64248019$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=36)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=36)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=36)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=36)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=36)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=36)"
## [1] "Cur Portfolio:"
##  [1] "NOC"  "ETN"  "UNP"  "ABT"  "BMY"  "ISRG" "AVGO" "CRM"  "IBM"  "TMUS"
## [11] "GOOG" "CHTR" "SCHW" "PGR"  "WFC"  "MAR"  "AMZN" "BKNG"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
```

```
## [1] "(tau=37) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1189317.25259252$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=37)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=37)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=37)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=37)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=37)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=37)"
## [1] "Cur Portfolio:"
##  [1] "HON"  "UPS"  "RTX"  "JNJ"  "MRK"  "PFE"  "AMD"  "CRM"  "ORCL" "GOOG"
## [11] "WBD"  "DIS"  "JPM"  "SCHW" "BAC"  "AZO"  "TSLA" "CMG"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=38) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1281723.89130924$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=38)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=38)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=38)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=38)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=38)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=38)"
## [1] "Cur Portfolio:"
##  [1] "CAT"  "GE"   "ITW"  "AMGN" "LLY"  "JNJ"  "AMD"  "QCOM" "ORCL" "EA"
## [11] "VZ"   "ATVI" "MS"   "BAC"  "SPGI" "GM"   "ORLY" "CMG"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=39) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1360214.78405188$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=39)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=39)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=39)"
```

```
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=39)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=39)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=39)"
## [1] "Cur Portfolio:"
##  [1] "ADP"  "GE"   "HON"  "MDT"  "ISRG" "BMY"  "QCOM" "AMD"  "INTC" "GOOG"
## [11] "T"    "DIS"  "JPM"  "C"    "CB"   "ORLY" "AZO"  "BKNG"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=40) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1412471.91218815$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=40)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=40)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=40)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=40)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=40)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=40)"
## [1] "Cur Portfolio:"
##  [1] "UPS"   "FDX"   "UNP"   "MDT"   "TMO"   "PFE"   "AAPL"  "TXN"   "NVDA"
## [10] "ATVI"  "CMCSA" "TMUS"  "MMC"   "AXP"   "MS"    "MCD"   "CMG"   "HD"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=41) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1480201.10598221$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=41)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=41)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=41)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=41)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=41)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=41)"
## [1] "Cur Portfolio:"
##  [1] "RTX"  "CSX"  "UNP"  "SYK"  "ELV"  "JNJ"  "INTU" "CSCO" "NVDA" "META"
## [11] "ATVI" "GOOG" "C"    "BLK"  "BAC"  "MAR"  "BKNG" "MCD"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
```

```
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=42) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1602176.10856369$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=42)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=42)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=42)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=42)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=42)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=42)"
## [1] "Cur Portfolio:"
##  [1] "DE"    "NOC"   "BA"    "ABT"   "ABBV"  "UNH"   "AVGO"  "QCOM"  "ORCL"
## [10] "OMC"   "GOOGL" "DIS"   "SCHW"  "MA"    "C"     "TSLA"  "TJX"   "MCD"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=43) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1551530.26776954$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=43)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=43)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=43)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=43)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=43)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=43)"
## [1] "Cur Portfolio:"
##  [1] "ADP"  "UNP"  "UPS"  "JNJ"  "MRK"  "PFE"  "AMD"  "IBM"  "NVDA" "CHTR"
## [11] "NFLX" "OMC"  "GS"   "V"    "JPM"  "ABNB" "TJX"  "MCD"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
```

```
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=44) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1483811.94406849$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=44)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=44)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=44)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=44)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=44)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=44)"
## [1] "Cur Portfolio:"
##  [1] "ADP"  "ITW"  "BA"   "BMY"  "TMO"  "DHR"  "CRM"  "ACN"  "NVDA" "TMUS"
## [11] "CHTR" "META" "SCHW" "MMC"  "C"    "SBUX" "CMG"  "AMZN"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=45) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1564590.61766242$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=45)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=45)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=45)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=45)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=45)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=45)"
## [1] "Cur Portfolio:"
##  [1] "ITW"  "CAT"  "LMT"  "SYK"  "UNH"  "DHR"  "MSFT" "NVDA" "ADBE" "VZ"
## [11] "OMC"  "EA"   "JPM"  "BAC"  "AXP"  "ORLY" "GM"   "SBUX"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=46) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1702504.51595118$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=46)"
```

```
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=46)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=46)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=46)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=46)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=46)"
## [1] "Cur Portfolio:"
##  [1] "UPS"  "CAT"  "LMT"  "UNH"  "BMY"  "DHR"  "CSCO" "MSFT" "ORCL" "ATVI"
## [11] "DIS"  "TMUS" "CB"   "BAC"  "GS"   "F"    "BKNG" "MCD"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
## [1] "(tau=47) CLOSE all positions."
## [1] "(1) COMPUTE_P/L(portfolio)"
## [1] "--> Capital:1760174.79721451$"
## [1] ""
## [1] "(2) PORTFOLIO_LOOP:"
## [1] "    SECTOR_PROCEDURE(G=Industrials, tau=47)"
## [1] "    SECTOR_PROCEDURE(G=Health Care, tau=47)"
## [1] "    SECTOR_PROCEDURE(G=Information Technology, tau=47)"
## [1] "    SECTOR_PROCEDURE(G=Communication Services, tau=47)"
## [1] "    SECTOR_PROCEDURE(G=Financials, tau=47)"
## [1] "    SECTOR_PROCEDURE(G=Consumer Discretionary, tau=47)"
## [1] "Cur Portfolio:"
##  [1] "GE"    "DE"    "BA"    "DHR"   "AMGN"  "BMY"   "CRM"   "CSCO"  "INTU"
## [10] "VZ"    "EA"    "GOOGL" "GS"    "CB"    "MS"    "AZO"   "MCD"   "BKNG"
## [1] ""
## [1] "(3) OPTIMIZE_PORTFOLIO(portfolio)"
## [1] "weights: "
##  [1] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [4] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
##  [7] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [10] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [13] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [16] "  0.0555555555555556" "  0.0555555555555556" "  0.0555555555555556"
## [1] ""
## [1] "(4) LONG PORTFOLIO()"
## [1] "-------------------------------------------------------------------------------------------------------"
```