task2

Making data

```r
symbols <-c("SPY", "SLY", "CWI", "SPAB")
start_date = ymd("2013-01-01")
cur_date = ymd("2018-01-01")
end_date = ymd("2023-02-28")
getSymbols(symbols, from=start_date, to=end_date)
```

```
## [1] "SPY"  "SLY"  "CWI"  "SPAB"
```

```r
prices <- do.call(merge, lapply(symbols, function(x) Ad(get(x))))
colnames(prices) <- symbols
#prices[c(1:4, nrow(prices)),]

prices_monthly <- to.monthly(prices, indexAt = "lastof", OHLC = FALSE)
returns <- Return.calculate(prices_monthly, method = "discrete")
returns <- na.omit(returns)

TBsymbols <- c("DGS3MO")
getSymbols(TBsymbols, from=start_date - days(10), to=end_date + days(10), src = "FRED")
```

```
## [1] "DGS3MO"
```

```r
dtx <- DGS3MO
dtx <- dtx[paste(cur_date, end_date, sep="/")]

prices_monthly_tb <- to.monthly(dtx, indexAt = "lastof", OHLC = FALSE)
```

```
## Warning in to.period(x, "months", indexAt = indexAt, name = name, ...): missing
## values removed from data
```

```r
returns_tb <- Return.calculate(prices_monthly_tb, method = "discrete")
returns_tb <- na.omit(returns_tb)
head(returns_tb)
```

```
##                DGS3MO
## 2018-02-28 0.13013699
## 2018-03-31 0.04848485
## 2018-04-30 0.08092486
## 2018-05-31 0.03208556
## 2018-06-30 0.00000000
## 2018-07-31 0.05181347
```

Making a matrix

```r
st <- 2013
cur <- 2018
```

```r
wgt.all <- xts(x = rbind(1:4), as.Date("2017-01-01"))
colnames(wgt.all) <- c("wgt.SPY", "wgt.SLY", "wgt.CWI", "wgt.SPAB")
rf <- c(as.numeric(DGS3MO["2018-01-02"]), as.numeric(DGS3MO["2019-01-02"]), as.numeric(DGS3MO["2020-01-0
rf
```

```
## [1] 1.44 2.42 1.54 0.09 0.08 4.53
```

```r
for (now in 0:5) {
  year(start_date) <- st + now
  year(cur_date) <- cur + now
  cur_returns <- subset(returns, start_date <= index(returns) & index(returns) <= cur_date)
  mat.ret <- matrix(cur_returns, nrow(cur_returns))
  colnames(mat.ret) <- symbols
  VCOV<-cov(mat.ret)
  options(scipen=100, digits=5)
  avg.ret<-matrix(apply(mat.ret,2,mean))
  rownames(avg.ret) <- symbols
  colnames(avg.ret) <- c("Avg.Ret")
  min.ret<-min(avg.ret)
  max.ret<-max(avg.ret)
  increments=100
  tgt.ret<-seq(min.ret,max.ret*2,length=increments)
  tgt.sd<-rep(0,length=increments)
  wgt<-matrix(0,nrow=increments,ncol=length(avg.ret))
  Dmat<-2*VCOV
  dvec<-c(rep(0,length(avg.ret)))
  Amat<-cbind(rep(1,length(avg.ret)),avg.ret)
  for (i in 1:length(tgt.ret)){
      bvec<-c(1,tgt.ret[i])
      soln<-solve.QP(Dmat,dvec,Amat,bvec=bvec,meq=2)
      tgt.sd[i]<-sqrt(soln$value)
      wgt[i,]<-soln$solution}
  colnames(wgt)<-c("wgt.SPY","wgt.SLY","wgt.CWI","wgt.SPAB")
  tgt.port<-data.frame(cbind(tgt.ret,tgt.sd,wgt))
  riskfree <- as.numeric(DGS3MO[cur_date + days(now + +7)])/100/12
  tgt.port$Sharpe <- (tgt.port$tgt.ret-riskfree) / tgt.port$tgt.sd
  tangency.port <- subset(tgt.port,tgt.port$Sharpe==max(tgt.port$Sharpe))
  wgt_now <- xts(tangency.port[3:6], cur_date)
  wgt.all <- rbind(wgt.all, wgt_now * 0.8)
}
```

```
## Warning in rbind(deparse.level, ...): mismatched types: converting objects to
## numeric
```

```r
wgt.all <- cbind(wgt.all['2018-01-01/2023-01-01'], 0.2)
colnames(wgt.all) <- c("wgt.SPY", "wgt.SLY", "wgt.CWI", "wgt.SPAB", "wgt.DGS3MO")
wgt.all
```

```
##            wgt.SPY   wgt.SLY  wgt.CWI wgt.SPAB wgt.DGS3MO
## 2018-01-01 0.80879 -0.067832 -0.41501  0.47405        0.2
## 2019-01-01 2.13686 -0.504781 -1.26993  0.43786        0.2
## 2020-01-01 0.70273 -0.127070 -0.36844  0.59278        0.2
## 2021-01-01 0.27426 -0.033132 -0.14279  0.70166        0.2
## 2022-01-01 0.34528 -0.058255 -0.14485  0.65783        0.2
## 2023-01-01 2.20752 -0.279796 -1.52162  0.39389        0.2
```

```r
returns <- subset(returns, "2018-01-01" <= index(returns) & index(returns) <= "2023-02-28")
new_returns <- cbind(returns, returns_tb)
head(new_returns)
```

```
##                  SPY         SLY        CWI         SPAB    DGS3MO
## 2018-01-31  0.0563593  0.0251125  0.0576922 -0.012178162        NA
## 2018-02-28 -0.0363607 -0.0376997 -0.0535758 -0.010484292 0.130137
## 2018-03-31 -0.0274104  0.0161754 -0.0048670  0.006936966 0.048485
## 2018-04-30  0.0051683  0.0124071  0.0066926 -0.008650089 0.080925
## 2018-05-31  0.0243089  0.0667705 -0.0204551  0.006370394 0.032086
## 2018-06-30  0.0057507  0.0098333 -0.0219804 -0.000071483 0.000000
```

```r
wgt.80.20 <- wgt.all

wgt.80.20
```

```
##             wgt.SPY   wgt.SLY  wgt.CWI wgt.SPAB wgt.DGS3MO
## 2018-01-01 0.80879 -0.067832 -0.41501  0.47405        0.2
## 2019-01-01 2.13686 -0.504781 -1.26993  0.43786        0.2
## 2020-01-01 0.70273 -0.127070 -0.36844  0.59278        0.2
## 2021-01-01 0.27426 -0.033132 -0.14279  0.70166        0.2
## 2022-01-01 0.34528 -0.058255 -0.14485  0.65783        0.2
## 2023-01-01 2.20752 -0.279796 -1.52162  0.39389        0.2
```

```r
port.80.20.rebal  <- Return.portfolio(new_returns,
                                      rebalance_on="years",
                                      weights=wgt.80.20,
                                      wealth.index=TRUE)
```

```
## Warning in Return.portfolio(new_returns, rebalance_on = "years", weights =
## wgt.80.20, : NA's detected: filling NA's with zeros
```

```r
port.80.20.norebal <- Return.portfolio(new_returns,
                                       weights=wgt.80.20,
                                       wealth.index=TRUE)
```

```
## Warning in Return.portfolio(new_returns, weights = wgt.80.20, wealth.index =
## TRUE): NA's detected: filling NA's with zeros
```

```r
rebal.wi.2 <-cbind(port.80.20.rebal,
                   port.80.20.norebal)
colnames(rebal.wi.2) <-c("Rebal", "NoRebal")
rebal.wi.2[c(1:4,nrow(rebal.wi.2)),]
```

```
##              Rebal NoRebal
## 2018-01-31  1.0142  1.0142
## 2018-02-28  1.0304  1.0304
## 2018-03-31  1.0229  1.0229
## 2018-04-30  1.0386  1.0386
## 2023-02-28 20.6378 20.6378
```

```r
plot.xts(rebal.wi.2, legend.loc = "topleft")
```

rebal.wi.2　　　　　　　　　　　　2018−01−31/2023−02−28