```r
## Load libraries
library(splines)
library(MASS)
library(xtable)
library(qvalue)

##Source functions
source("../functions.R")
```

Simulations are performed for a variety of alternative distributions:

```r
alts <- c("alt_beta","alt_chisq_large_3_3","alt_chisq_large",
          "alt_chisq_small_3_3","alt_chisq_small",
          "alt_t_large","alt_t_small",
          "alt_z_large",
          "alt_z_small")
```

Make FDR-TPR table:

```r
for(alt in alts)
{
  ##For each simulation, get the FDR-TPR table: (BL = Boca-Leek method)
  scen1 <- scen2a <- scen2b <- scen3a <- scen3b <- NULL

  ##------------------Set 1---------------##

  ##Load p-values and £\pi_0(x)£ estimates for the simulations:
  for(l in listSimRes(alt, 1))
  {
    load(l)
  }

  ##Get BH and Storey q-values for each simulation:
  qValuesSimsBH <- getQValuesSimsBH(pValuesSims)
  qValuesSimsStorey <- getQValuesSimsStorey(pValuesSims)

  ##Get estimated FDR for each simulation for the final estimates
  FDRreg <- getFDRregSims(pi0EstSim, qValuesSimsBH)

  ##get FDR-TPR table
  scen1 <- estFDR.TPR(FDR.BL = FDRreg,
                      FDR.BH = qValuesSimsBH, FDR.Storey = qValuesSimsStorey,
                      FDR.Scott = FDR.ScottMat, FDR.Scott_emp = FDR.ScottMat_emp, nullHypSim

  ##------------------Set 2---------------##
```

```r
##Load p-values and £\pi_0(x)£ estimates for the simulations:
for(l in listSimRes(alt, 2))
{
  load(l)
}

##Get BH and Storey q-values for each simulation:
qValuesSimsBH <- getQValuesSimsBH(pValuesSims)
qValuesSimsStorey <- getQValuesSimsStorey(pValuesSims)

##--------Linear fit-------##

##Get estimated FDR for each simulation for the final estimates
FDRreg <- getFDRregSims(pi0EstSim.lin, qValuesSimsBH)

##get FDR-TPR table
scen2a <- estFDR.TPR(FDR.BL = FDRreg,
                     FDR.BH = qValuesSimsBH, FDR.Storey = qValuesSimsStorey,
                     FDR.Scott = FDR.Lin.ScottMat, FDR.Scott_emp = FDR.Lin.ScottMat_emp, n

##--------Spline fit-------##

##Get estimated FDR for each simulation for the final estimates
FDRreg <- getFDRregSims(pi0EstSim.spl, qValuesSimsBH)

##get FDR-TPR table
scen2b <- estFDR.TPR(FDR.BL = FDRreg,
                     FDR.BH = qValuesSimsBH, FDR.Storey = qValuesSimsStorey,
                     FDR.Scott = FDR.Spl.ScottMat, FDR.Scott_emp = FDR.Spl.ScottMat_emp, n

##-----------------Set 3---------------##

##Load p-values and £\pi_0(x)£ estimates for the simulations:
for(l in listSimRes(alt, 3))
{
  load(l)
}

##Get BH and Storey q-values for each simulation:
qValuesSimsBH <- getQValuesSimsBH(pValuesSims)
qValuesSimsStorey <- getQValuesSimsStorey(pValuesSims)

##--------Linear fit-------##

##Get estimated FDR for each simulation for the final estimates
```

```
FDRreg <- getFDRregSims(pi0EstSim.lin, qValuesSimsBH)

##get FDR-TPR table
scen3a <- estFDR.TPR(FDR.BL = FDRreg,
                     FDR.BH = qValuesSimsBH, FDR.Storey = qValuesSimsStorey,
                     FDR.Scott = FDR.Lin.ScottMat, FDR.Scott_emp = FDR.Lin.ScottMat_emp, r

##--------Spline fit-------##

##Get estimated FDR for each simulation for the final estimates
FDRreg <- getFDRregSims(pi0EstSim.spl, qValuesSimsBH)

##get FDR-TPR table
scen3b <- estFDR.TPR(FDR.BL = FDRreg,
                     FDR.BH = qValuesSimsBH, FDR.Storey = qValuesSimsStorey,
                     FDR.Scott = FDR.Spl.ScottMat, FDR.Scott_emp = FDR.Spl.ScottMat_emp, r

##------------------Set 4---------------##

##Load p-values and £\pi_0(x)£ estimates for the simulations:
for(l in listSimRes(alt, 4))
{
  load(l)
}

##Get BH and Storey q-values for each simulation:
qValuesSimsBH <- getQValuesSimsBH(pValuesSims)
qValuesSimsStorey <- getQValuesSimsStorey(pValuesSims)

##--------Linear fit-------##

##Get estimated FDR for each simulation:
##first pull out just the final estimates
pi0_final <- lapply(pi0EstSim.lin, function(x){x[[3]]})

FDRreg <- t(mapply(function(q,pi0){q*pi0}, data.frame(t(qValuesSimsBH)), pi0_final, SIMPLI

##get FDR-TPR table
scen4a <- estFDR.TPR(FDR.BL = FDRreg,
                     FDR.BH = qValuesSimsBH, FDR.Storey = qValuesSimsStorey,
                     FDR.Scott = FDR.Lin.ScottMat, FDR.Scott_emp = FDR.Lin.ScottMat_emp, r

##--------Spline fit-------##

##Get estimated FDR for each simulation:
```

```r
  ##first pull out just the final estimates
  pi0_final <- lapply(pi0EstSim.spl, function(x){x[[3]]})

  FDRreg <- t(mapply(function(q,pi0){q*pi0}, data.frame(t(qValuesSimsBH)), pi0_final, SIMPL

  ##get FDR-TPR table
  scen4b <- estFDR.TPR(FDR.BL = FDRreg,
                       FDR.BH = qValuesSimsBH, FDR.Storey = qValuesSimsStorey,
                       FDR.Scott = FDR.Spl.ScottMat, FDR.Scott_emp = FDR.Spl.ScottMat_emp, r

  print("")
  print(alt)
  print(scen1)
  print(scen2a)
  print(scen2b)
  print(scen3a)
  print(scen3b)
  print(scen4a)
  print(scen4b)

  save(list=c("scen1","scen2a","scen2b","scen3a","scen3b","scen4a","scen4b"),
       file=paste(alt,"FDR_TPR_sims.RData",sep="/"))
}
## [1] ""
## [1] "alt_beta"
##                  FDR          TPR Percent used
## BL         0.05000000 0.001951840        100.0
## Scott      0.89954500 1.000000000        100.0
## Scott_emp  0.84046627 0.958894729         75.5
## Storey     0.05250000 0.001906795        100.0
## BH         0.03916667 0.001445886        100.0
##                  FDR          TPR Percent used
## BL         0.04833333 0.001550654        100.0
## Scott      0.92632500 1.000000000        100.0
## Scott_emp  0.85904596 0.979518293         79.5
## Storey     0.04833333 0.001166801        100.0
## BH         0.04083333 0.001093272        100.0
##                  FDR          TPR Percent used
## BL         0.06500000 0.001552679        100.0
## Scott      0.92632500 1.000000000        100.0
## Scott_emp  0.86603128 0.983138218         79.5
## Storey     0.04833333 0.001166801        100.0
## BH         0.04083333 0.001093272        100.0
##                  FDR          TPR Percent used
## BL         0.05166667 0.002146207          100
```

```
## Scott      0.94856500 1.000000000          100
## Scott_emp 0.88903011 0.975174083           78
## Storey     0.05416667 0.001876110          100
## BH         0.05416667 0.001876110          100
##                   FDR         TPR Percent used
## BL         0.06166667 0.002519005          100
## Scott      0.94856500 1.000000000          100
## Scott_emp 0.89436435 0.975948408           78
## Storey     0.05416667 0.001876110          100
## BH         0.05416667 0.001876110          100
##                   FDR         TPR Percent used
## BL         0.06439110 0.121715055          100
## Scott      0.56734500 1.000000000          100
## Scott_emp        NA          NA            0
## Storey     0.05058619 0.054040383          100
## BH         0.03372985 0.003338835          100
##                   FDR         TPR Percent used
## BL         0.07921145 0.154448402          100
## Scott      0.56734500 1.000000000          100
## Scott_emp        NA          NA            0
## Storey     0.05058619 0.054040383          100
## BH         0.03372985 0.003338835          100
## [1] ""
## [1] "alt_chisq_large_3_3"
##                   FDR       TPR Percent used
## BL         0.05341275 0.3082754          100
## Scott      0.89954500 1.0000000          100
## Scott_emp 0.83455914 0.9534077           95
## Storey     0.05395371 0.3058190          100
## BH         0.04834402 0.2958929          100
##                   FDR       TPR Percent used
## BL         0.05273820 0.2840034        100.0
## Scott      0.92632500 1.0000000        100.0
## Scott_emp 0.89601798 0.9848436         99.5
## Storey     0.05331255 0.2750067        100.0
## BH         0.04994776 0.2671000        100.0
##                   FDR       TPR Percent used
## BL         0.05371318 0.2917129        100.0
## Scott      0.92632500 1.0000000        100.0
## Scott_emp 0.89921827 0.9862607         99.5
## Storey     0.05331255 0.2750067        100.0
## BH         0.04994776 0.2671000        100.0
##                   FDR       TPR Percent used
## BL         0.05853321 0.2482776          100
## Scott      0.94856500 1.0000000          100
```

```
## Scott_emp 0.92393598 0.9833760             99
## Storey    0.05435515 0.2402515            100
## BH        0.05345426 0.2342449            100
##                  FDR       TPR Percent used
## BL        0.05922928 0.2521774            100
## Scott     0.94856500 1.0000000            100
## Scott_emp 0.92992403 0.9872291             99
## Storey    0.05435515 0.2402515            100
## BH        0.05345426 0.2342449            100
##                  FDR       TPR Percent used
## BL        0.05118123 0.5230945            100
## Scott     0.56734500 1.0000000            100
## Scott_emp 0.55922911 0.9876498             28
## Storey    0.04740946 0.5168515            100
## BH        0.02763305 0.4450779            100
##                  FDR       TPR Percent used
## BL        0.05461861 0.5269882            100
## Scott     0.56734500 1.0000000            100
## Scott_emp 0.55938095 0.9879333             28
## Storey    0.04740946 0.5168515            100
## BH        0.02763305 0.4450779            100
## [1] ""
## [1] "alt_chisq_large"
##                  FDR       TPR Percent used
## BL        0.04999166 0.5116271          100.0
## Scott     0.89954500 1.0000000          100.0
## Scott_emp 0.85499169 0.9866320           96.5
## Storey    0.04807658 0.5093932          100.0
## BH        0.04360780 0.4965026          100.0
##                  FDR       TPR Percent used
## BL        0.04842959 0.4826783          100.0
## Scott     0.92632500 1.0000000          100.0
## Scott_emp 0.89350245 0.9956366           97.5
## Storey    0.04794688 0.4709166          100.0
## BH        0.04416100 0.4630599          100.0
##                  FDR       TPR Percent used
## BL        0.04980752 0.4891368          100.0
## Scott     0.92632500 1.0000000          100.0
## Scott_emp 0.89981779 0.9958737           97.5
## Storey    0.04794688 0.4709166          100.0
## BH        0.04416100 0.4630599          100.0
##                  FDR       TPR Percent used
## BL        0.04982625 0.4429267          100
## Scott     0.94856500 1.0000000          100
## Scott_emp 0.93759610 0.9968405           99
```

```
## Storey     0.04945105 0.4308903         100
## BH         0.04750937 0.4247327         100
##                   FDR       TPR Percent used
## BL         0.05343757 0.4477006         100
## Scott      0.94856500 1.0000000         100
## Scott_emp  0.93871022 0.9970987          99
## Storey     0.04945105 0.4308903         100
## BH         0.04750937 0.4247327         100
##                   FDR       TPR Percent used
## BL         0.05117916 0.7162476         100
## Scott      0.56734500 1.0000000         100
## Scott_emp         NA        NA           0
## Storey     0.04720856 0.7109875         100
## BH         0.02806396 0.6514715         100
##                   FDR       TPR Percent used
## BL         0.05304052 0.7186921         100
## Scott      0.56734500 1.0000000         100
## Scott_emp         NA        NA           0
## Storey     0.04720856 0.7109875         100
## BH         0.02806396 0.6514715         100
## [1] ""
## [1] "alt_chisq_small_3_3"
##                   FDR         TPR Percent used
## BL         0.07255556 0.008662193         100
## Scott      0.89954500 1.000000000         100
## Scott_emp  0.87999760 0.828279461          70
## Storey     0.06255556 0.008607753         100
## BH         0.05888889 0.008374021         100
##                   FDR         TPR Percent used
## BL         0.05023611 0.008586545         100
## Scott      0.92632500 1.000000000         100
## Scott_emp  0.89619368 0.846103979          71
## Storey     0.05173611 0.008006679         100
## BH         0.04717262 0.007586995         100
##                   FDR         TPR Percent used
## BL         0.05000000 0.008293118         100
## Scott      0.92632500 1.000000000         100
## Scott_emp  0.89988621 0.854578203          71
## Storey     0.05173611 0.008006679         100
## BH         0.04717262 0.007586995         100
##                   FDR         TPR Percent used
## BL         0.06483333 0.006838517         100
## Scott      0.94856500 1.000000000         100
## Scott_emp  0.92600045 0.866727088          75
## Storey     0.06400000 0.006218365         100
```

```
## BH         0.05700000 0.006132158          100
##                    FDR        TPR Percent used
## BL         0.06783333 0.007019064          100
## Scott      0.94856500 1.000000000          100
## Scott_emp  0.92979346 0.871091193           75
## Storey     0.06400000 0.006218365          100
## BH         0.05700000 0.006132158          100
##                    FDR        TPR Percent used
## BL         0.04950210 0.01796875         100.0
## Scott      0.56734500 1.00000000         100.0
## Scott_emp  0.50328614 0.76300489          74.5
## Storey     0.04616745 0.01708028         100.0
## BH         0.04014459 0.01370930         100.0
##                    FDR        TPR Percent used
## BL         0.05071834 0.01861373         100.0
## Scott      0.56734500 1.00000000         100.0
## Scott_emp  0.50865336 0.76917650          74.5
## Storey     0.04616745 0.01708028         100.0
## BH         0.04014459 0.01370930         100.0
## [1] ""
## [1] "alt_chisq_small"
##                    FDR        TPR Percent used
## BL         0.04004960 0.03061533          100
## Scott      0.89954500 1.00000000          100
## Scott_emp  0.86026833 0.82968421           76
## Storey     0.04045833 0.03034135          100
## BH         0.03320833 0.02941577          100
##                    FDR        TPR Percent used
## BL         0.05630159 0.02278873         100.0
## Scott      0.92632500 1.00000000         100.0
## Scott_emp  0.87909221 0.85122456          78.5
## Storey     0.04892063 0.02190392         100.0
## BH         0.04917063 0.02159655         100.0
##                    FDR        TPR Percent used
## BL         0.05931349 0.02393050         100.0
## Scott      0.92632500 1.00000000         100.0
## Scott_emp  0.87939675 0.85768769          78.5
## Storey     0.04892063 0.02190392         100.0
## BH         0.04917063 0.02159655         100.0
##                    FDR        TPR Percent used
## BL         0.05141667 0.02219645         100.0
## Scott      0.94856500 1.00000000         100.0
## Scott_emp  0.91166974 0.86748302          86.5
## Storey     0.04350000 0.02133745         100.0
## BH         0.04241667 0.02065111         100.0
```

```
##                FDR        TPR Percent used
## BL        0.05492857 0.02277200        100.0
## Scott     0.94856500 1.00000000        100.0
## Scott_emp 0.91179832 0.87218359         86.5
## Storey    0.04350000 0.02133745        100.0
## BH        0.04241667 0.02065111        100.0
##                FDR        TPR Percent used
## BL        0.03691339 0.07375251        100
## Scott     0.56734500 1.00000000        100
## Scott_emp 0.49794845 0.81903682         73
## Storey    0.03407316 0.07139827        100
## BH        0.02713549 0.06080670        100
##                FDR        TPR Percent used
## BL        0.03810798 0.07585683        100
## Scott     0.56734500 1.00000000        100
## Scott_emp 0.50116659 0.82100183         73
## Storey    0.03407316 0.07139827        100
## BH        0.02713549 0.06080670        100
## [1] ""
## [1] "alt_t_large"
##                FDR       TPR Percent used
## BL        0.05694322 0.1568195        100
## Scott     0.21318158 0.5541295        100
## Scott_emp 0.23355335 0.5690983        100
## Storey    0.05502398 0.1521425        100
## BH        0.04843184 0.1360035        100
##                FDR       TPR Percent used
## BL        0.04758411 0.1298639        100
## Scott     0.20666280 0.6446058        100
## Scott_emp 0.23836783 0.6547283        100
## Storey    0.05003389 0.1159324        100
## BH        0.04376258 0.1056487        100
##                FDR       TPR Percent used
## BL        0.04684918 0.1381427        100
## Scott     0.21059922 0.6481542        100
## Scott_emp 0.24491670 0.6564942        100
## Storey    0.05003389 0.1159324        100
## BH        0.04376258 0.1056487        100
##                FDR        TPR Percent used
## BL        0.06157486 0.09408780        100
## Scott     0.26809184 0.54633052        100
## Scott_emp 0.30985967 0.54678563        100
## Storey    0.05885497 0.08178553        100
## BH        0.05406091 0.07572923        100
##                FDR        TPR Percent used
```

```
## BL         0.06793054 0.10008271           100
## Scott      0.27303889 0.55172785           100
## Scott_emp  0.31285257 0.55322423           100
## Storey     0.05885497 0.08178553           100
## BH         0.05406091 0.07572923           100
##                    FDR        TPR Percent used
## BL         0.05037590 0.5249882           100
## Scott      0.09297654 0.7286749           100
## Scott_emp  0.02794174 0.4441566           100
## Storey     0.04730285 0.5195930           100
## BH         0.02865974 0.4033814           100
##                    FDR        TPR Percent used
## BL         0.05370492 0.5302949           100
## Scott      0.09341767 0.7295840           100
## Scott_emp  0.02791136 0.4459875           100
## Storey     0.04730285 0.5195930           100
## BH         0.02865974 0.4033814           100
## [1] ""
## [1] "alt_t_small"
##                    FDR         TPR Percent used
## BL         0.07666667 0.001796208           100
## Scott      0.46003063 0.084206265           100
## Scott_emp  0.44188776 0.092857085           100
## Storey     0.07666667 0.001587584           100
## BH         0.07666667 0.001442703           100
##                    FDR         TPR Percent used
## BL         0.0695000 0.002768259           100
## Scott      0.4350775 0.109824245           100
## Scott_emp  0.4586776 0.109720375           100
## Storey     0.0645000 0.002569000           100
## BH         0.0645000 0.002127544           100
##                    FDR         TPR Percent used
## BL         0.06866667 0.003141470           100
## Scott      0.43719049 0.113951357           100
## Scott_emp  0.45507707 0.114398647           100
## Storey     0.06450000 0.002569000           100
## BH         0.06450000 0.002127544           100
##                    FDR         TPR Percent used
## BL         0.0800000 0.002108632           100
## Scott      0.5973022 0.077811564           100
## Scott_emp  0.5829466 0.087765854           100
## Storey     0.0800000 0.001976403           100
## BH         0.0800000 0.001833283           100
##                    FDR         TPR Percent used
## BL         0.0875000 0.002392134           100
```

```
## Scott      0.5985801 0.080186866          100
## Scott_emp 0.5906203 0.090968579          100
## Storey     0.0800000 0.001976403          100
## BH         0.0800000 0.001833283          100
##                     FDR        TPR Percent used
## BL         0.03968398 0.007356401          100
## Scott      0.15038108 0.139461815          100
## Scott_emp 0.10558269 0.080552475          100
## Storey     0.03345734 0.006592882          100
## BH         0.03394053 0.004757086          100
##                     FDR        TPR Percent used
## BL         0.04676884 0.007917570          100
## Scott      0.15049087 0.140696001          100
## Scott_emp 0.10630426 0.081639298          100
## Storey     0.03345734 0.006592882          100
## BH         0.03394053 0.004757086          100
## [1] ""
## [1] "alt_z_large"
##                     FDR       TPR Percent used
## BL         0.04987169 0.5099702          100
## Scott      0.05244247 0.5094888          100
## Scott_emp 0.06590108 0.4974688          100
## Storey     0.04876093 0.5081392          100
## BH         0.04406380 0.4969158          100
##                     FDR       TPR Percent used
## BL         0.05394619 0.4852853          100
## Scott      0.05662850 0.6350251          100
## Scott_emp 0.08085186 0.6134574          100
## Storey     0.05266540 0.4764023          100
## BH         0.04925492 0.4695397          100
##                     FDR       TPR Percent used
## BL         0.05598406 0.4929255          100
## Scott      0.05947830 0.6354941          100
## Scott_emp 0.08295914 0.6149134          100
## Storey     0.05266540 0.4764023          100
## BH         0.04925492 0.4695397          100
##                     FDR       TPR Percent used
## BL         0.05793651 0.4509699          100
## Scott      0.05913016 0.6032959          100
## Scott_emp 0.09943899 0.5786749          100
## Storey     0.05419544 0.4400385          100
## BH         0.05084388 0.4337851          100
##                     FDR       TPR Percent used
## BL         0.05922129 0.4560561          100
## Scott      0.05995634 0.6085792          100
```

```
## Scott_emp 0.10140147 0.5817328          100
## Storey    0.05419544 0.4400385          100
## BH        0.05084388 0.4337851          100
##                  FDR       TPR Percent used
## BL        0.04975254 0.7164064          100
## Scott     0.04919670 0.7184060          100
## Scott_emp 0.02377998 0.6062543          100
## Storey    0.04688963 0.7117715          100
## BH        0.02780684 0.6542942          100
##                  FDR       TPR Percent used
## BL        0.05236504 0.7196263          100
## Scott     0.05005387 0.7189591          100
## Scott_emp 0.02437117 0.6071701          100
## Storey    0.04688963 0.7117715          100
## BH        0.02780684 0.6542942          100
## [1] ""
## [1] "alt_z_small"
##                  FDR       TPR Percent used
## BL        0.05589881 0.03188285          100
## Scott     0.05472817 0.02781127          100
## Scott_emp 0.11215185 0.04569293          100
## Storey    0.05257738 0.03140774          100
## BH        0.05023214 0.03007326          100
##                  FDR       TPR Percent used
## BL        0.05159939 0.02579223          100
## Scott     0.05107520 0.05045846          100
## Scott_emp 0.12884809 0.08113511          100
## Storey    0.05039105 0.02505514          100
## BH        0.04993651 0.02460052          100
##                  FDR       TPR Percent used
## BL        0.05366685 0.02658068          100
## Scott     0.05124190 0.05472064          100
## Scott_emp 0.14262377 0.08537738          100
## Storey    0.05039105 0.02505514          100
## BH        0.04993651 0.02460052          100
##                  FDR       TPR Percent used
## BL        0.08272024 0.02489327          100
## Scott     0.03682341 0.04283833          100
## Scott_emp 0.14819768 0.06681714           99
## Storey    0.07434524 0.02444456          100
## BH        0.06934524 0.02414950          100
##                  FDR       TPR Percent used
## BL        0.07876190 0.02544827          100
## Scott     0.05355177 0.04614136          100
## Scott_emp 0.15242393 0.06958799           99
```

```
## Storey     0.07434524 0.02444456         100
## BH         0.06934524 0.02414950         100
##                   FDR        TPR Percent used
## BL         0.04015670 0.07674906         100
## Scott      0.04033579 0.08216187         100
## Scott_emp  0.02783462 0.04714461         100
## Storey     0.03735624 0.07474051         100
## BH         0.03112061 0.06375623         100
##                   FDR        TPR Percent used
## BL         0.04066081 0.07849420         100
## Scott      0.04331698 0.08378698         100
## Scott_emp  0.03722637 0.05262702         100
## Storey     0.03735624 0.07474051         100
## BH         0.03112061 0.06375623         100
```

Session info:

```
devtools::session_info()
```

```
## Session info ------------------------------------------------

##   setting  value
##   version  R version 3.3.1 (2016-06-21)
##   system   x86_64, mingw32
##   ui       RTerm
##   language (EN)
##   collate  English_United States.1252
##   tz       America/New_York
##   date     2017-06-22

## Packages ----------------------------------------------------

##   package    * version date       source
##   assertthat   0.1     2013-12-06 CRAN (R 3.3.1)
##   colorspace   1.2-6   2015-03-11 CRAN (R 3.3.1)
##   devtools     1.12.0  2016-06-24 CRAN (R 3.3.3)
##   digest       0.6.9   2016-01-08 CRAN (R 3.3.1)
##   evaluate     0.10    2016-10-11 CRAN (R 3.3.1)
##   ggplot2      2.2.1   2016-12-30 CRAN (R 3.3.3)
##   gtable       0.2.0   2016-02-26 CRAN (R 3.3.1)
##   highr        0.6     2016-05-09 CRAN (R 3.3.1)
##   knitr      * 1.15.1  2016-11-22 CRAN (R 3.3.1)
##   lazyeval     0.2.0   2016-06-12 CRAN (R 3.3.1)
##   magrittr     1.5     2014-11-22 CRAN (R 3.3.1)
##   MASS       * 7.3-45  2016-04-21 CRAN (R 3.3.1)
##   memoise      1.0.0   2016-01-29 CRAN (R 3.3.1)
##   munsell      0.4.3   2016-02-13 CRAN (R 3.3.1)
```

```
## plyr        1.8.4   2016-06-08 CRAN (R 3.3.1)
## qvalue    * 2.4.2   2016-05-16 Bioconductor
## Rcpp       0.12.10 2017-03-19 CRAN (R 3.3.3)
## reshape2   1.4.1   2014-12-06 CRAN (R 3.3.1)
## scales     0.4.1   2016-11-09 CRAN (R 3.3.3)
## stringi    1.1.1   2016-05-27 CRAN (R 3.3.0)
## stringr    1.0.0   2015-04-30 CRAN (R 3.3.1)
## tibble     1.2     2016-08-26 CRAN (R 3.3.2)
## withr      1.0.2   2016-06-20 CRAN (R 3.3.1)
## xtable   * 1.8-2   2016-02-05 CRAN (R 3.3.1)
```