

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

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

Simulations are performed for a variety of alternative distributions:

```
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:

```
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  $E\pi_0(x)$  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-----##
```

```

##Load p-values and  $\pi_0(x)$  estimates for the simulations:
for(l in listSimRes(alt, 2))
{
  load(1)
}

##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, r

##-----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, r

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

##Load p-values and  $\pi_0(x)$  estimates for the simulations:
for(l in listSimRes(alt, 3))
{
  load(1)
}

##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:

```

```

##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, SIMPLI

##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          0.03700000 0.0001801052      100.0
## Scott        0.90014850 1.0000000000      100.0
## Scott_emp    0.90016181 1.0000000000       99.5
## Storey       0.03700000 0.0001801052      100.0
## BH           0.03616667 0.0001551536      100.0
##           FDR          TPR Percent used
## BL          0.03083333 0.0002035583       100
## Scott        0.92587700 1.0000000000       100
## Scott_emp    0.92587700 1.0000000000       100
## Storey       0.03083333 0.0001565015       100
## BH           0.03000000 0.0001565015       100
##           FDR          TPR Percent used
## BL          0.03083333 0.0002237986       100
## Scott        0.92587700 1.0000000000       100
## Scott_emp    0.92587700 1.0000000000       100
## Storey       0.03083333 0.0001565015       100
## BH           0.03000000 0.0001565015       100
##           FDR          TPR Percent used
## BL          0.04000000 0.0001256615       100

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## Scott      0.9486415 1.0000000000      100
## Scott_emp  0.9486404 1.0000000000      99
## Storey     0.0350000 0.0001155809      100
## BH         0.0350000 0.0001052928      100
##           FDR          TPR Percent used
## BL         0.0450000 0.0001360565      100
## Scott      0.9486415 1.0000000000      100
## Scott_emp  0.9486404 1.0000000000      99
## Storey     0.0350000 0.0001155809      100
## BH         0.0350000 0.0001052928      100
##           FDR          TPR Percent used
## BL         0.04398119 0.0122282933      100
## Scott      0.56870950 1.0000000000      100
## Scott_emp   NA          NA              0
## Storey     0.04766879 0.0050416009      100
## BH         0.02459040 0.0003102373      100
##           FDR          TPR Percent used
## BL         0.05013933 0.0199943022      100
## Scott      0.56870950 1.0000000000      100
## Scott_emp   NA          NA              0
## Storey     0.04766879 0.0050416009      100
## BH         0.02459040 0.0003102373      100
## [1] ""
## [1] "alt_chisq_large_3_3"
##           FDR          TPR Percent used
## BL         0.05038802 0.2974263      100
## Scott      0.90014850 1.0000000      100
## Scott_emp  0.90014850 1.0000000      100
## Storey     0.05043161 0.2974229      100
## BH         0.04532031 0.2874058      100
##           FDR          TPR Percent used
## BL         0.04910648 0.2800230      100
## Scott      0.92587700 1.0000000      100
## Scott_emp  0.92587700 1.0000000      100
## Storey     0.04994228 0.2708622      100
## BH         0.04687084 0.2649899      100
##           FDR          TPR Percent used
## BL         0.04868581 0.2838509      100
## Scott      0.92587700 1.0000000      100
## Scott_emp  0.92587700 1.0000000      100
## Storey     0.04994228 0.2708622      100
## BH         0.04687084 0.2649899      100
##           FDR          TPR Percent used
## BL         0.05249217 0.2426240      100
## Scott      0.94864150 1.0000000      100

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## Scott_emp 0.94864150 1.0000000 100
## Storey 0.05198538 0.2359225 100
## BH 0.04961398 0.2321865 100
## FDR TPR Percent used
## BL 0.05231222 0.2442294 100
## Scott 0.94864150 1.0000000 100
## Scott_emp 0.94864150 1.0000000 100
## Storey 0.05198538 0.2359225 100
## BH 0.04961398 0.2321865 100
## FDR TPR Percent used
## BL 0.04720523 0.5182180 100.0
## Scott 0.56870950 1.0000000 100.0
## Scott_emp 0.57075714 1.0000000 3.5
## Storey 0.04694086 0.5167668 100.0
## BH 0.02841505 0.4475972 100.0
## FDR TPR Percent used
## BL 0.04735480 0.5187015 100.0
## Scott 0.56870950 1.0000000 100.0
## Scott_emp 0.57075714 1.0000000 3.5
## Storey 0.04694086 0.5167668 100.0
## BH 0.02841505 0.4475972 100.0
## [1] ""
## [1] "alt_chisq_large"
## FDR TPR Percent used
## BL 0.04992740 0.5065315 100
## Scott 0.90014850 1.0000000 100
## Scott_emp 0.90014850 1.0000000 100
## Storey 0.04982659 0.5064742 100
## BH 0.04507402 0.4956380 100
## FDR TPR Percent used
## BL 0.04892529 0.4820037 100
## Scott 0.92587700 1.0000000 100
## Scott_emp 0.92587700 1.0000000 100
## Storey 0.04960789 0.4717792 100
## BH 0.04569686 0.4635510 100
## FDR TPR Percent used
## BL 0.04847870 0.4858638 100
## Scott 0.92587700 1.0000000 100
## Scott_emp 0.92587700 1.0000000 100
## Storey 0.04960789 0.4717792 100
## BH 0.04569686 0.4635510 100
## FDR TPR Percent used
## BL 0.05014062 0.4395577 100
## Scott 0.94864150 1.0000000 100
## Scott_emp 0.94864150 1.0000000 100

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## Storey      0.04997196 0.4321289      100
## BH          0.04782477 0.4269699      100
##              FDR          TPR Percent used
## BL          0.05037074 0.4417391      100
## Scott       0.94864150 1.0000000      100
## Scott_emp   0.94864150 1.0000000      100
## Storey      0.04997196 0.4321289      100
## BH          0.04782477 0.4269699      100
##              FDR          TPR Percent used
## BL          0.04773427 0.7113716      100
## Scott       0.56870950 1.0000000      100
## Scott_emp   NA          NA          0
## Storey      0.04758025 0.7101354      100
## BH          0.02844283 0.6515505      100
##              FDR          TPR Percent used
## BL          0.04793122 0.7117650      100
## Scott       0.56870950 1.0000000      100
## Scott_emp   NA          NA          0
## Storey      0.04758025 0.7101354      100
## BH          0.02844283 0.6515505      100
## [1] ""
## [1] "alt_chisq_small_3_3"
##              FDR          TPR Percent used
## BL          0.05588352 0.004374358      100.0
## Scott       0.90014850 1.000000000      100.0
## Scott_emp   0.90013166 1.000000000      99.5
## Storey      0.05644930 0.004364696      100.0
## BH          0.05568821 0.004258809      100.0
##              FDR          TPR Percent used
## BL          0.05896284 0.003786449      100
## Scott       0.92587700 1.000000000      100
## Scott_emp   0.92591616 1.000000000      99
## Storey      0.06412951 0.003686268      100
## BH          0.06329618 0.003610690      100
##              FDR          TPR Percent used
## BL          0.05983189 0.003879890      100
## Scott       0.92587700 1.000000000      100
## Scott_emp   0.92591616 1.000000000      99
## Storey      0.06412951 0.003686268      100
## BH          0.06329618 0.003610690      100
##              FDR          TPR Percent used
## BL          0.06390079 0.003364668      100.0
## Scott       0.94864150 1.000000000      100.0
## Scott_emp   0.94862814 1.000000000      99.5
## Storey      0.06681746 0.003286853      100.0

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## BH      0.06688690 0.003235488      100.0
##          FDR      TPR Percent used
## BL      0.06348413 0.003384324      100.0
## Scott    0.94864150 1.000000000      100.0
## Scott_emp 0.94862814 1.000000000      99.5
## Storey    0.06681746 0.003286853      100.0
## BH      0.06688690 0.003235488      100.0
##          FDR      TPR Percent used
## BL      0.03648377 0.01570084      100
## Scott    0.56870950 1.000000000      100
## Scott_emp 0.56868434 1.000000000      99
## Storey    0.03600993 0.01558154      100
## BH      0.02954534 0.01292525      100
##          FDR      TPR Percent used
## BL      0.03661985 0.01575204      100
## Scott    0.56870950 1.000000000      100
## Scott_emp 0.56868434 1.000000000      99
## Storey    0.03600993 0.01558154      100
## BH      0.02954534 0.01292525      100
## [1] ""
## [1] "alt_chisq_small"
##          FDR      TPR Percent used
## BL      0.04675710 0.02310579      100
## Scott    0.90014850 1.000000000      100
## Scott_emp 0.90015455 1.000000000      99
## Storey    0.04640441 0.02299092      100
## BH      0.04323486 0.02215884      100
##          FDR      TPR Percent used
## BL      0.05160792 0.01912256      100
## Scott    0.92587700 1.000000000      100
## Scott_emp 0.92588838 1.000000000      99
## Storey    0.05194276 0.01862739      100
## BH      0.05123292 0.01821753      100
##          FDR      TPR Percent used
## BL      0.05200295 0.01940442      100
## Scott    0.92587700 1.000000000      100
## Scott_emp 0.92588838 1.000000000      99
## Storey    0.05194276 0.01862739      100
## BH      0.05123292 0.01821753      100
##          FDR      TPR Percent used
## BL      0.04856758 0.01534389      100.0
## Scott    0.94864150 1.000000000      100.0
## Scott_emp 0.94865685 1.000000000      98.5
## Storey    0.04826934 0.01473764      100.0
## BH      0.04830979 0.01457395      100.0

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##          FDR          TPR Percent used
## BL          0.04836514 0.01556766      100.0
## Scott        0.94864150 1.00000000      100.0
## Scott_emp    0.94865685 1.00000000       98.5
## Storey       0.04826934 0.01473764      100.0
## BH           0.04830979 0.01457395      100.0
##          FDR          TPR Percent used
## BL          0.03562998 0.07186136      100.0
## Scott        0.56870950 1.00000000      100.0
## Scott_emp    0.56869849 1.00000000       99.5
## Storey       0.03593538 0.07158702      100.0
## BH           0.02926360 0.06111337      100.0
##          FDR          TPR Percent used
## BL          0.03603455 0.07195040      100.0
## Scott        0.56870950 1.00000000      100.0
## Scott_emp    0.56869849 1.00000000       99.5
## Storey       0.03593538 0.07158702      100.0
## BH           0.02926360 0.06111337      100.0
## [1] ""
## [1] "alt_t_large"
##          FDR          TPR Percent used
## BL          0.05156920 0.1413328      100
## Scott        0.21679671 0.5533824      100
## Scott_emp    0.20788838 0.5322975      100
## Storey       0.05121535 0.1410240      100
## BH           0.04662848 0.1262586      100
##          FDR          TPR Percent used
## BL          0.04558570 0.1147426      100
## Scott        0.19981528 0.6569400      100
## Scott_emp    0.19936003 0.6536347      100
## Storey       0.04917543 0.1024570      100
## BH           0.04485754 0.0924984      100
##          FDR          TPR Percent used
## BL          0.04453287 0.1204800      100
## Scott        0.20190300 0.6574039      100
## Scott_emp    0.20148230 0.6542250      100
## Storey       0.04917543 0.1024570      100
## BH           0.04485754 0.0924984      100
##          FDR          TPR Percent used
## BL          0.04927168 0.06773425      100
## Scott        0.24681300 0.62460353      100
## Scott_emp    0.26803101 0.63730172      100
## Storey       0.05217810 0.05971629      100
## BH           0.05211931 0.05492284      100
##          FDR          TPR Percent used

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## BL      0.04832136 0.07005785      100
## Scott   0.24797626 0.62612967      100
## Scott_emp 0.26928622 0.63907431      100
## Storey   0.05217810 0.05971629      100
## BH       0.05211931 0.05492284      100
##          FDR          TPR Percent used
## BL      0.04813761 0.5182922      100
## Scott   0.09326501 0.7284492      100
## Scott_emp 0.01222393 0.2850707      100
## Storey   0.04787731 0.5164582      100
## BH       0.02891815 0.4019615      100
##          FDR          TPR Percent used
## BL      0.04814676 0.5189370      100
## Scott   0.09331981 0.7286028      100
## Scott_emp 0.01229413 0.2856909      100
## Storey   0.04787731 0.5164582      100
## BH       0.02891815 0.4019615      100
## [1] ""
## [1] "alt_t_small"
##          FDR          TPR Percent used
## BL      0.05908333 0.0002976598      100
## Scott   0.45893701 0.0823723693      100
## Scott_emp 0.46207348 0.0843754947      100
## Storey   0.05908333 0.0002976598      100
## BH       0.05541667 0.0002730119      100
##          FDR          TPR Percent used
## BL      0.0787500 0.0003075512      100
## Scott   0.4521543 0.1041067228      100
## Scott_emp 0.4755499 0.1065859670      100
## Storey   0.0787500 0.0002873627      100
## BH       0.0787500 0.0002873627      100
##          FDR          TPR Percent used
## BL      0.0787500 0.0003406773      100
## Scott   0.4448529 0.1073669015      100
## Scott_emp 0.4698458 0.1095127177      100
## Storey   0.0787500 0.0002873627      100
## BH       0.0787500 0.0002873627      100
##          FDR          TPR Percent used
## BL      0.0812500 0.0003495909      100
## Scott   0.5596357 0.0909046758      100
## Scott_emp 0.5872793 0.0968826080      100
## Storey   0.0812500 0.0003391307      100
## BH       0.0812500 0.0003391307      100
##          FDR          TPR Percent used
## BL      0.0812500 0.0003391307      100

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## Scott      0.5556546 0.0926080382      100
## Scott_emp  0.5822775 0.0990048380      100
## Storey     0.0812500 0.0003391307      100
## BH         0.0812500 0.0003391307      100
##           FDR          TPR Percent used
## BL         0.03667280 0.003062926      100
## Scott      0.15113673 0.137568917      100
## Scott_emp  0.09503206 0.064570231      100
## Storey     0.03634225 0.003003643      100
## BH         0.02929753 0.001736907      100
##           FDR          TPR Percent used
## BL         0.03612316 0.003091762      100
## Scott      0.15129686 0.137680075      100
## Scott_emp  0.09485720 0.064694333      100
## Storey     0.03634225 0.003003643      100
## BH         0.02929753 0.001736907      100
## [1] ""
## [1] "alt_z_large"
##           FDR          TPR Percent used
## BL         0.04975513 0.5064633      100
## Scott      0.04994533 0.5063831      100
## Scott_emp  0.05887183 0.5209223      100
## Storey     0.04954030 0.5065332      100
## BH         0.04491480 0.4957233      100
##           FDR          TPR Percent used
## BL         0.04925271 0.4841525      100
## Scott      0.05241358 0.6388865      100
## Scott_emp  0.05298246 0.6289395      100
## Storey     0.04925485 0.4730709      100
## BH         0.04617947 0.4660183      100
##           FDR          TPR Percent used
## BL         0.04907004 0.4882848      100
## Scott      0.05196910 0.6397282      100
## Scott_emp  0.05264251 0.6295905      100
## Storey     0.04925485 0.4730709      100
## BH         0.04617947 0.4660183      100
##           FDR          TPR Percent used
## BL         0.04918503 0.4417890      100
## Scott      0.05248772 0.6023499      100
## Scott_emp  0.05464651 0.5930179      100
## Storey     0.04907765 0.4346142      100
## BH         0.04666994 0.4296511      100
##           FDR          TPR Percent used
## BL         0.04917346 0.4440387      100
## Scott      0.05218686 0.6061170      100

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## Scott_emp 0.05430511 0.5965718      100
## Storey    0.04907765 0.4346142      100
## BH        0.04666994 0.4296511      100
##           FDR          TPR Percent used
## BL        0.04774741 0.7129065      100
## Scott      0.04959447 0.7180685      100
## Scott_emp  0.02297804 0.6217568      100
## Storey     0.04752174 0.7118180      100
## BH         0.02844312 0.6531338      100
##           FDR          TPR Percent used
## BL        0.04788445 0.7132579      100
## Scott      0.04961257 0.7183181      100
## Scott_emp  0.02298978 0.6220703      100
## Storey     0.04752174 0.7118180      100
## BH         0.02844312 0.6531338      100
## [1] ""
## [1] "alt_z_small"
##           FDR          TPR Percent used
## BL        0.04486098 0.02275498      100
## Scott      0.04181064 0.02182907      100
## Scott_emp  0.03203863 0.01589514      100
## Storey     0.04421373 0.02270703      100
## BH         0.04282583 0.02177593      100
##           FDR          TPR Percent used
## BL        0.04882152 0.01999052      100
## Scott      0.04091324 0.04702477      100
## Scott_emp  0.03728488 0.04155173      100
## Storey     0.04962363 0.01940610      100
## BH         0.04817092 0.01904258      100
##           FDR          TPR Percent used
## BL        0.04868542 0.02023837      100
## Scott      0.04166507 0.05009867      100
## Scott_emp  0.03829508 0.04363148      100
## Storey     0.04962363 0.01940610      100
## BH         0.04817092 0.01904258      100
##           FDR          TPR Percent used
## BL        0.04687381 0.01587448      100
## Scott      0.04201984 0.03616332      100
## Scott_emp  0.04856121 0.03356878      100
## Storey     0.04824859 0.01545078      100
## BH         0.04668075 0.01515060      100
##           FDR          TPR Percent used
## BL        0.04338471 0.01610611      100
## Scott      0.04204644 0.03750369      100
## Scott_emp  0.04870215 0.03469725      100

```

```
## Storey      0.04824859 0.01545078      100
## BH          0.04668075 0.01515060      100
##              FDR          TPR Percent used
## BL          0.035943462 0.07244075      100
## Scott       0.039218383 0.07809887      100
## Scott_emp   0.005162502 0.01789073      100
## Storey      0.035856909 0.07225321      100
## BH          0.028526820 0.06169256      100
##              FDR          TPR Percent used
## BL          0.036039835 0.07261939      100
## Scott       0.039458323 0.07821824      100
## Scott_emp   0.004775125 0.01799370      100
## Storey      0.035856909 0.07225321      100
## BH          0.028526820 0.06169256      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)
```