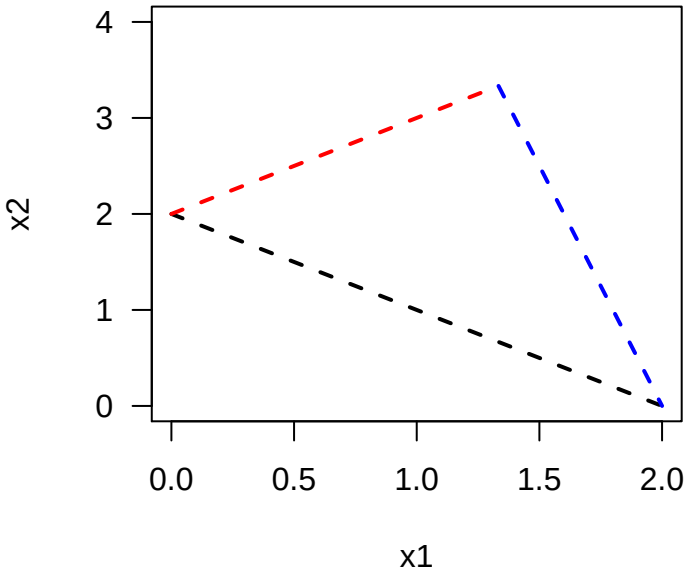
Suppose that we would like to construct an Mm/ARD design in the constrained region shown below.



To install the package from a local machine use the code below. Note that the package *lpSolveAPI* is also necessary and needs to be installed.

```
install.packages("CoNcaD_1.0.tar.gz", repos = NULL, type = "source")
library("CoNcaD")
```

```
## Loading required package: lpSolveAPI
```

Set up the inputs for *concad* function and run the function.

```
p <- 2
n <- 20
u <- 100
Q <- 3*n
alpha <- 0.5
J <- 1:2
num.of.starts <- 50

Amatrix <- matrix(c(-1, -1,
                    -1, +1,
                    +5, +1), 3, 2, byrow=T)

bvector <- c(-2, 2, 10)
lb <- c(0, 0)
ub <- c(2, 3.5)

#?concad
designObject <- concad (p = p,
                        n = n,
                        Q = Q,
                        u = u,
                        alpha = 1,
                        J = J,
                        A = Amatrix,
                        b = bvector,
                        UB = ub,
```

```
                        LB = lb,
                        num.of.starts = num.of.starts)
```

Show the output and plot the design in the constrained region.

```
designObject
```

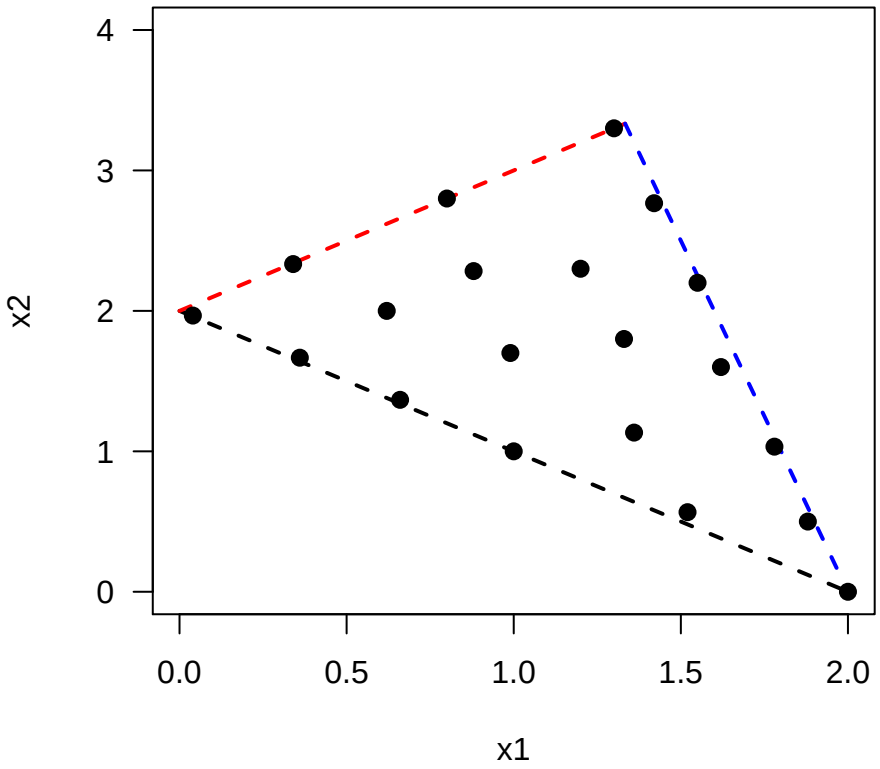
```
## $scaledDesign
##        [,1]  [,2]
##  [1,] 0.310 0.600
##  [2,] 1.000 0.000
##  [3,] 0.650 0.990
##  [4,] 0.810 0.480
##  [5,] 0.500 0.300
##  [6,] 0.600 0.690
##  [7,] 0.760 0.170
##  [8,] 0.020 0.590
##  [9,] 0.400 0.840
## [10,] 0.495 0.510
## [11,] 0.330 0.410
## [12,] 0.890 0.310
## [13,] 0.680 0.340
## [14,] 0.775 0.660
## [15,] 0.170 0.700
## [16,] 0.710 0.830
## [17,] 0.180 0.500
## [18,] 0.940 0.150
## [19,] 0.665 0.540
## [20,] 0.440 0.685
##
## $unscaledDesign
##       [,1]      [,2]
##  [1,] 0.62 2.0000000
##  [2,] 2.00 0.0000000
##  [3,] 1.30 3.3000000
##  [4,] 1.62 1.6000000
##  [5,] 1.00 1.0000000
##  [6,] 1.20 2.3000000
##  [7,] 1.52 0.5666667
##  [8,] 0.04 1.9666667
##  [9,] 0.80 2.8000000
## [10,] 0.99 1.7000000
## [11,] 0.66 1.3666667
## [12,] 1.78 1.0333333
## [13,] 1.36 1.1333333
## [14,] 1.55 2.2000000
## [15,] 0.34 2.3333333
## [16,] 1.42 2.7666667
## [17,] 0.36 1.6666667
## [18,] 1.88 0.5000000
## [19,] 1.33 1.8000000
## [20,] 0.88 2.2833333
##
## $MIPD
## [1] 0.1553222
```

```
##
## $ARD
## [1] 7.47073
##
## $marginalExtrema
##    min      max
## x1   0 2.000000
## x2   0 3.333333
##
## $n
## [1] 20
##
## $p
## [1] 2
##
## $Q
## [1] 60
##
## $u
## [1] 100
##
## $A
##      [,1] [,2]
## [1,]   -1   -1
## [2,]   -1    1
## [3,]    5    1
##
## $b
## [1] -2  2 10
##
## $LB
## [1] 0 0
##
## $UB
## [1] 2.0 3.5
##
## $alpha
## [1] 1
##
## $J
## [1] 1 2
##
## $num.of.starts
## [1] 50
##
## $executionTime
##    user  system elapsed
##  16.649   0.282  16.965
##
## $X1
## NULL
##
## $MIPDvalues
##  [1] 0.1360147 0.1331353 0.1297112 0.1400893 0.1389244 0.1346291 0.1431782
```

```
##  [8] 0.1431782 0.1431782 0.1281601 0.1500833 0.1389244 0.1389244 0.1303840
## [15] 0.1360147 0.1470544 0.1414214 0.1392839 0.1553222 0.1308625 0.1431782
## [22] 0.1414214 0.1346291 0.1486607 0.1360147 0.1392839 0.1379311 0.1341641
## [29] 0.1360147 0.1297112 0.1431782 0.1392839 0.1500000 0.1312440 0.1346291
## [36] 0.1389244 0.1277693 0.1353699 0.1523155 0.1456022 0.1523155 0.1442221
## [43] 0.1421267 0.1414214 0.1386542 0.1400893 0.1432655 0.1360147 0.1320984
## [50] 0.1476482
##
## $ARDvalues
##  [1] 7.115467 7.188582 7.710378 7.972684 7.057433 7.412379 6.380972
##  [8] 6.747879 6.453482 7.554943 7.211042 6.833238 6.394592 6.929064
## [15] 6.756671 7.078517 7.107545 7.217295 7.470730 7.876736 6.690576
## [22] 7.294588 7.478536 8.004124 7.231408 7.090529 7.167695 7.137328
## [29] 6.700869 8.239546 6.129063 7.351458 6.366225 8.152062 8.923776
## [36] 6.726665 7.318938 7.294413 6.604424 6.902389 6.717455 8.241290
## [43] 6.592216 6.768767 8.799532 7.262082 6.667154 7.441823 7.095390
## [50] 7.393718
```

```r
####### Plot
x1 <- seq(0, 2, .01)
x21 <- 2 - x1
x2 <- c(0, 4/3)
x3 <- c(4/3, 2)

plot(x1, x21, type = "l", xlim = c(0, 2), ylim = c(0, 4), las = 1, lwd = 2,
     ylab = "x2", lty = 2)
lines(x2, 2 + x2, col = "red", lty = 2, lwd = 2)
lines(x3, 10 - 5*x3, col = "blue", lty = 2, lwd = 2)
points(designObject$unscaledDesign, pch = 16, cex = 1.25)
```



For more examples and help menu type *?concad* in R and see Draguljić, Dean, and Santner (2012).