Table 10.14 *EESPRS BBD Designs*

$k_1(k_2)$	k	m	n	N
1(2)	3	5	4	20
1(3)	4	7	6	42
1(4)	5	7	8	56
2(2)	4	11	4	44
2(3)	5	13	6	78

(where **J** is given in equation 10.20) Marcharia and Goos (2010) used an exchange algorithm to search for designs that were both estimation equivalent and D-efficient. Jones and Goos (2012) improved the algorithm, by implementing a dual objective function, and found more efficient estimation-equivalent designs for many of the cases Marcharia and Goos studied. Jones and Goos compiled a catalog of 111 D-efficient estimation-equivalent response surface designs produced by their algorithm. Most of these designs have three levels for all factors coded as –1, 0, and 1, and all of the designs have all factor levels bounded between –1 and 1. This catalog of designs (except for the few cases where the number of runs is too few to estimate the intercept, factor effect, and variance components) can be recalled by functions in the `daewr` package. Table 10.15 lists the functions to do this.

Table 10.15 `daewr` *Functions for Recalling Jones and Goos's D-Efficient EESPRS Designs*

Function Name	Number of Whole-Plot Factors	Number of Split-Plot Factors
EEw1s1	1	1
EEw1s2	1	2
EEw1s3	1	3
EEw2s1	2	1
EEw2s2	2	2
EEw2s3	2	2
EEw3	3	2 or 3

Calling one of the functions without any arguments produces a table listing the names of the designs that can be recalled with that function, and calling the function with a design name as the argument recalls a data frame containing the design (as shown in the example on the next page).

```
> library(daewr)
> EEw1s2( )
Catalog of D-efficient Estimation Equivalent RS
  Designs for (1 wp factor and  2 sp factors)
   Jones and Goos, JQT(2012) pp. 363-374

Design Name whole plots sub-plots/whole plot
---------------------------------------
EE12R4WP         4                3
EE12R6WP         6                2
EE14R7WP         7                2
EE15R5WP         5                3
EE16R4WP         4                4
EE18R6WP         6                3
EE20R4WP         4                5
EE20R5WP         5                4
EE21R7WP         7                3
EE24R4WP         4                6
EE24R6WP         6                4
EE25R5WP         5                5
EE28R7WP         7                4
EE30R5WP         5                6
EE30R6WP         6                5
EE35R7WP         7                5
EE36R6WP         6                6
EE42R7WP         7                6
==> to retrieve a design type EEw1s2('EE12R6WP') etc.
> EE15R5WP<-EEw1s2('EE15R5WP')
> EE15R5WP
   WP w1 s1 s2
1    1 -1 -1 -1
2    1 -1  1  0
3    1 -1  0  1
4    2  0  1 -1
5    2  0  0  0
6    2  0 -1  1
7    3 -1  1  1
8    3 -1  0 -1
9    3 -1 -1  0
10   4  1  1 -1
11   4  1 -1  1
12   4  1  1  1
13   5 -1  0  1
14   5 -1  1  0
15   5 -1 -1 -1
```