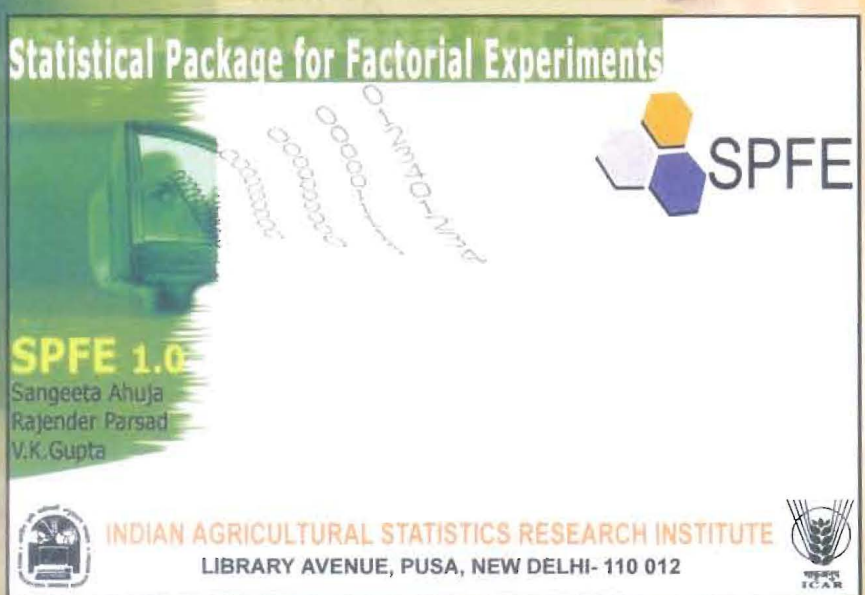
SPFE 1.0

Statistical Package for Factorial Experiments



SPFE 1.0
(Statistical Package for Factorial Experiments)

Statistical Package for Factorial Experiments (SPFE) 1.0 has been developed by ***Ms Sangeeta Ahuja, Dr. Rajender Parsad and Dr. V.K.Gupta*** at IASRI, Library Avenue, New Delhi - 110 012. This package generates designs for symmetrical and asymmetrical factorial experiments with or without confounding. It also generates randomized layout of designs for factorial experiments. The design for a factorial experiment with confounding is generated on listing the independent interactions to be confounded. Different sets of interactions and different number of independent interactions can be assigned for confounding in different replications. It also generates regular fractional factorial plans for symmetrical factorial experiments. The data generated are analyzed as per procedure of unblocked/block designs for single factor experiments. The treatment sum of squares can be partitioned into sum of squares due to main effects and interactions. A null hypothesis on any other contrast of interest can also be tested.

This package is also useful for teaching the subject of factorial experiments to the post-graduate students in the class. The package also contains useful information for **researchers in Statistics** with interest in experimental designs particularly in factorial experiments.

SPFE is **user – friendly, interactive, Password protected Software**. It is completely **Menu-Driven** and can also be operated using the **TOOLBARS**.

Complete Help with **Index, Contents** and **Search** facility is available. Users will not have to seek any help in selecting, generating, randomizing the design or analyzing the data generated. The package runs on **WINDOWS** Platform.

Main Features of SPFE

- **Generation of the design**
- **Randomized layout of the design**
- **Analysis of the data generated from Unblocked/block design for single/multi-factor experiment**
- **Probability generation**

Besides the features listed above, the package also works as an Editor with limited facilities *viz.* Open, save and print files; cut, copy, paste the text: undo the last action, etc.

Generation of the Design

This module has the following four options viz.

(i) **Complete factorial without confounding**
(ii) **Complete factorial with confounding**
(iii) **Fractional Factorial Plans**
(iv) **Balanced Confounded Designs**

When the option complete factorial without confounding is selected, the user is asked to enter the number of factors (n), the number of levels of each factor (s) and the number of replications (r). Once these options are entered the design is generated. When the option complete factorial with confounding is selected, the user is prompted to enter the number of factors, the number of levels of each factor, the number of replications, the number of independent interactions to be confounded per replication and then the independent interactions to be confounded. The package generates designs for factorial experiments up to 20 factors.

The option "fractional factorial plan" gives regular fractional factorial plans only after getting the values of n and s. After entering these parameters, user is asked to select one of the two available options *viz.* (1) estimating main effects only, (2) estimating main effects and two factor interactions. If a setup for generation of fractional factorial is possible it proceeds further; otherwise it gives an error message to the user, and prompts the user to select some

other setup. SPFE makes this decision by checking that the number of runs is equal to or more than the number of parameters to be estimated.

Selection of option (iv) provides a list of commonly used designs for balanced confounded factorial experiments. It has a facility of displaying the generated design and its randomized layout.

Randomization

This module gives the randomized layout by randomizing first the replications, followed by the blocks within replication (only in case of confounded factorials) and then the treatment combinations within blocks within replication.

Analysis

The option **Analysis** in the Menu-Bar consists of the following sub-options, which are displayed as POP-Up Menus

- **Single Factor**
- **Multiple Factor**
- **Main Effects and Interactions**
- **Single df Contrasts**
- **User Defined Contrast**
- **Look Up Table**

The options Single Factor, Multiple Factor and Look Up Table always remain activated and other options remain deactivated. The options Single Factor and Multiple Factor have two sub-options *viz.* **Unblocked Designs** and **Block Designs**. For the analysis of data user has to create a data file in ASCII mode.

The option *Single Factor* is useful for the analysis of data from single factor experiments conducted using an unblocked (completely randomized) design or a block design. If the data is generated through a completely randomized design, then select the option *Unblocked Designs* under the option Single Factor. If the data is generated from a block design (randomized complete block design or an incomplete block design), then select the option *Block Designs* under the option Single Factor. Once the option *Unblocked Designs/Block Designs* is selected, the data file name is to be provided either directly writing the complete path of the file or selecting the file through the Browse Button on the Window Dialog Box. The data is then analyzed as per usual procedure of unblocked/ block designs for single factor experiments. It provides the Analysis of Variance (ANOVA) table with probability level for testing the equality of the treatment or treatment and block effects. Besides ANOVA table, it also gives the value of coefficient of determination (R^2), Root Mean Square Error, General mean and coefficient of variation. Further, the package also gives treatment means and their standard errors, probability level of significance of all possible pairwise treatment comparisons. If the data is balanced and orthogonal, then the critical differences at 1% and 5% level of significance are also displayed.

The option *Multiple Factor* is useful for the analysis of data from multiple factor experiments conducted using an unblocked design or a block design. If the data is generated through a completely randomized design then select the option *Unblocked Designs* under the option Multiple Factor. If the data is generated from a block (complete or incomplete) design, then select the option *Block Designs* under the option Multiple Factor. For multiple factor experiments, the $\prod_{i=1}^{n} s_i = v$ treatment combinations are renumbered automatically in lexicographic order from 1 to v, where s_i denotes the number of levels of factor i, $i = 1, \ldots, n$. The identity relationship between the renumbered treatments and the treatment combinations can be seen using the Look Up Tables. The data is then analyzed as per usual procedure of unblocked/block designs for single factor experiments. The contrasts for main effects and interactions are generated by the package. The sum of squares for main effects and interactions are then obtained along with probability level of significance. The package also

facilitates the generation of the single degree of freedom contrasts for various factorial effects using the orthogonal polynomials for equi-spaced factor-levels and testing their significance.

The option *User Defined Contrasts* can be used for testing the significance of contrasts of interest. SPFE computes and analyzes the user defined contrasts and gives results such as ANOVA along with contrasts and their estimates. Facility is there to input + and – coefficients to represent the contrasts, in parallel to the columns of the treatments.

Probability Generation

Under this module we can generate the probability for t, χ^2 and F distributions.
On selection of the option *t-Distribution*, user has to enter:

- X, the value above which we want to compute the probability
- n, the degrees of freedom

On entering these values, it generates the probability of t- distribution greater than X i.e. Prob $[|t| > X]$.

On selection of the option *Chi Square Distribution*, user has to enter:

- X, the value above which we want to compute the probability
- n, the degrees of freedom

On entering these values, it generates the probability of Chi-square distribution greater than X i.e. Prob $[\chi^2 > X]$.

On selection of the option *F- Distribution*, user has to enter:

- X, the value above which we want to compute the probability
- n_1 and n_2, the degrees of freedom

On entering these values, the package generates the probability of F- distribution greater than X i.e. Prob $[F > X]$.

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