## Chapter – 4: DEVELOPMENT OF THEORETICAL MODEL

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4.1. About JMP software

JMP is usually pronounced as ‘jump’, which is a computer program developed for analyzing statistical data. It had been developed by SAS Institute. It was started during 1980’s to take the advantage of graphical user interface introduced by Macintosh. Since then it has been improving and now made available for other operating systems. JMP is used in real life applications such as Six Sigma, quality governance and control, design of experiments and other scientific research.

JMP had been developed during 1980’s by John Sall and a team of developers for use of graphical user interface, which has been introduced in 1984 by Apple Macintosh [117]. Basically it was ‘John’s Macintosh Program’ [118] and was first released in October 1989 [117]. It was used mostly by scientists and engineers for design of experiments (DOE), quality and product support like six sigma, and modeling of reliability [119]. Semiconductor manufacturers were also among the users of JMP [120].

Interactive graphs and other salient features were added in 1991[121-123] with version 2.0. Version 2 has twice the size of original, and was developed in a floppy disk. It requires 2 MB of memory and available with 700 page document [123]. Microsoft Windows support was added in the year 1994
JMP was re-written with the version 3 in 1999 [125-126] and version 4 was released in 2002, where wider variety of data sources [127] and added support for surface plots in included [121]. Version 4 also had added time series forecasting and smoothing models, like seasonal smoothing method, called Winter’s Method, and the ARIMA (Autoregressive Integrated Moving Average [128].

During 2005, data mining tools like a decision tree and neural net were also added with version 5 [129], and also Linux support, which was later withdrawn starting with JMP9 [130]. After that JMP 6 was introduced [131]. JMP started interacting with SAS with version 7.0 in 2007 and more with every version. JMP was prepared such that users can write SAS code in JMP, connect to SAS servers and retrieve the use data from SAS. The Support for bubble plots was added in version 7 [132]. JMP 7 also improved data visualization and diagnostics [133].

Version JMP 8 had been released in the year 2009 with new drag and drop features and a 64-bit version to take advantage of advances in the Mac operating system [134]. It also added a new user interface for building graphics, and then tools of choice of experiments and support for Life Distribution [135]. With respect to scientific computing, the software had improvements in ‘graphics, QA, ease of use, SAS integration and the area of data management [136]. JMP 9 in 2010 had been added a new interface for use of R programming language from JMP and an add in for excel [137-138]. The
main screen was rebuilt and enhanced to simulations, graphics and use of Degradation platform [139]. During March 2012, version 10 had been introduced with improvements in data mining, predictive analytics and auto model building [140-141].

JMP software focuses on experimental data analysis and visualization. It had been designed to investigate the data and extract something unexpected, close to real applications [142-143]. JMP connects the statistical data to graphical representation, so that users can find the data and various visual representations from it [128,142,144]. Its primary applications are design and analysis of statistical data from industrial processes [120].

JMP runs in memory mode, instead of on disk storage [137]. With respect to a review in pharmaceutical statistics, JMP is used as a graphical end user for a SAS system, which responds the statistical analysis and tabulations [144]. JMP Genomics is used for analyzing and visualizing genomic data [145] which requires a SAS component to be operated and can access SAS/Genetics and SAS/STAT methods [146]. JMP clinical is used for analyzing the data of clinical trials, and can be used for confirming output [133].

JMP is also been named as SAS Institute business unit that provides and develops JMP, as of 2011 and it had 180 employees and 250000 users [137].
1.2. JMP Other Applications

During 2007, a wildlife monitoring organization, Wild Track, had used JMP with the Foot print Identification Technology (FIT) to identify individual endangered animals with their foot prints [147]. Researchers identified that the seedless, starchy fruit had been created by the deliberate hybridization of two fruits, the breadnut and dugdug [118]. The Herzenberg Laboratory at Stanford had integrated JMP with the Fluorescence Activated Cell Sorter (FACS), which study about different areas [148]

1.3. Estimation of relationships for Cement strength with various physical and chemical constituents

Different cement samples were tested physically and chemically and it is tried to develop the equations for 1 day, 3 days, 7 days and 28 days strengths of the samples. JMP software was used to develop the equation. JMP is statistical discovery software, used to perform simple and complex statistical. It dynamically links statistics with graph’s to interactively explore, understand, and visualize data. To establish the relation, some samples were excluded those having large deviation amongst all. JMP provides a comprehensive set of statistical tools as well as Design of Experiments and Statistical Quality Control in a single package.

The equations are developed as strength as a function of physical and chemical constituents like Loss On Ignition, Insoluble Residue, Sulfuric anhydride, <10, <30, and <53 micron particles.
1.4. Procedure of analysis

In JMP software at first, all the results were enrolled and a least square model was used to fit the data with a suitable $R^2$ value. $R^2$ indicates sum of the squares of residuals. A residual is a difference between actual and predicted value. For a best fit $R^2$ should be closed to 1. But here the $R^2$ value was found to be too low. As a result, different combinations of new interaction parameters were introduced and the $R^2$ value was found to increase.

The significant properties for different day’s strengths and setting times were determined based on leverage plots. A plot that compares residuals from these models is called a leverage plot. If the probability value ($p$) from a leverage plot is greater than 0.05 infers, the property said to be not significant. This same significance can also be decided by the solid straight line in the graph. The property is not significant if the line is horizontal.

Statistical analysis of experimental data can also be performed using other tools like SPSS software, MAT lab, Skylab etc., however JMP is considered to be the best software and user friendly for analyzing large data.