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Multiple Regression Model for the Significance of Age and Weight of Pregnant Mothers' In Relation to their Birth Weight.

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Abstract:

Most developed and developing countries have shown clear tendencies towards motherhood over the last decades. In this paper, we develop a multiple regression model for the relationship between dependent or response variable and two or more independent or predictor variables. The independent variable is deterministic if the value of the dependent variable is completely determined, with no uncertainty; once values of the independent variables have been specified. We consider three parts in this model, the response variable which is the Birth weight, the Mathematical function, usually denoted by $f(\underset{x}{\rightarrow};\underset{\beta}{\rightarrow})$ (age and weight) and the random errors usually denoted by ξ. The general multiple regression models are: $E(y) = \beta_0+\beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 +\dots + \beta_kx_k + \xi$. Where y is the response variable, $x_1, x_2, x_3 \dots x_k$ are the predictors and ξ is the residual error. The model developed was generated by the use of statistical software Minitab 14. The model is: **Birth weight = 2.23 + 0.0100 mother's age(x_1) + 0.0121 mother's weight(x_2).** There are numerous factors that may affect the weight of a newly born baby due to the dynamic nature of the mother, but in this paper we are interested in the two parameters, Age and Weight of the pregnant mother. A regression analysis is carried out to determine the significant contribution of the parameters to the baby's birth weight. The data set used shows that both Mother's age and weight contributed significantly to the birth weight with $p < 0.05$ for both age and weight of pregnant mothers' in relation to their birth weight.

Keywords: Regressor, Regressand, Sums of squares, Total variation, Variation due to Regression and Residual variation.

Introduction:

Multiple regressions are a "general linear model" with a wide range of applications. In Statistics, Multiple regression (MR) is a regression method of modeling the conditional expected value of one variable say y, given the values of some other variables, say , $x_1, x_2, x_3, \dots x_k$.

The primary uses of multiple regressions are:

- Prediction of continuous Y with several continuous X variables, multiple regressions allows the use of an entire set of variables to predict another.
- The use of categorical variables in prediction, through the technique of dummy coding, categorical variables (such as marital status, gender or treatment group).
- Calculation of the unequal n ANOVA problem, estimates effects and interactions in situation by the use of dummy codes.
- Model non-linear relationship between Y and a set of X; by the addition of "Polynomial terms such as Quadratic, cubic trends etc in the equations relationship that do not meet the linear assumptions can be analyzed.

Background:

There are many advances in birth control and the overall status of women in the work place. Therefore, it is no surprise that more and more young women are choosing to delay pregnancy until later in life. Infact, about 20% of women are now giving birth to children after the age of 35 years. The question here asked was, that, do these women have the same

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chance of getting pregnant as young women? Or does a woman's ability to get pregnant decline after a certain age? However, research shows that pregnancies in women over the age of 35 years are more problematic than those in younger women.

According to the Mayo clinic (2007) report on a woman's fertility, stated that Woman's fertility peaks is between the ages of 20 to 24 years. However fertility rates remain relatively constant through the early 30's, after which they begin to decline. Further stressed, that, age affects the rates of infertility treatment as well as your natural ability to get pregnant. For example, if you are healthy 30 years old women, you have about 20% changes per month to get pregnant. By age 40 years, however, your chance is only about 5% per month.

Studies have shown that fertility decreases with age particularly after 35 years. Even through women today are healthier and taking better care of themselves than ever before, improved health in later life does not offset the natural age-related decline in fertility. It is also reported that risk of miscarriage increases after age 35 years, by the early 40's more that 50% of pregnancies end in miscarriage; many of these occur at an early stage and may not even be detected, or may be mistaken for late period.

The A to Z reproductive health reported, that, the majority of those miscarriage are due to chromosomal abnormality in foetus. Pregnant women older than 35 years may have a higher risk of developing gestational diabetes preeclampsia and placenta previa. There is also a potentially higher risk of having a baby with low weight and chromosomal abnormalities such as Down syndrome, less frequent and/or irregular ovulation and endometriosis in which tissue that attaches to the ovaries or fallopian tubes interferes with conception.

Martin et al (2005) stated that the age of the mother is also afactor in birth weight. When a woman is between the ages of 18 and 35, she is in the prime of her child bearing years and is more likely to conceive a healthy child. The incidence of low birth weight is higher among mothers' under the age of 18 0r overage of 35. For these two age group especially pregnant women under the age of 40, their uterus does not sustain pregnancy as well as during the prime child bearing years. These complications arise because the human organism is just not organized for women to bear children.

Studies have shown that the primary determinant for the possibility of pregnancy is "Puberty". It takes the female body a few cycles to begin to produce an environment conducive to pregnancy.

Objectives:

The objectives of the work are to determine if the age and weight of the pregnant women have any effect on the birth weight. It is also to predict what the weight will be, knowing the age and weight of the pregnant women.

Data presentation:

A data set of one hundred (100) ages and weights of pregnant women when they were about to give birth and their corresponding birth weights was randomly selected. The data for this study are secondary data obtained from the statistical records of Statistics department of the General Hospital, Minna, Niger State. We ensure that the data satisfied the assumptions of Multiple regression analysis, which are (i) at any given combination of values $x_1, x_2, ..., x_k$, the population of potential error term values has a mean equal to zero

(ii) the different populations of potential error term values to different combinations of values of $x_1, x_2, x_3, \ldots x_k$, have equal variances ($\sigma^2$).

(iii) at any given combinations of values of $x_1, x_2, x_3, \ldots x_k$, the population of potential error term values has a normal distribution, and

(iv) at one value of the error term ξ is statistically independent of any other value of ξ.

Hypothesis:

We have the following hypotheses for this work:

H_{01}: There is no significance difference between ages of pregnant mothers in relation to the birth weight.

H_{11}: There is significance difference between ages of the pregnant mothers in relation to the birth weight.

H_{02}: There is no significance difference between weights of mothers in relation to the birth weight.

H_{12}: There is significance difference between weights of mothers in relation to the birth weight.

H_{03}: There is no significant difference between age and weight of pregnant mothers in relation to the birth weight.

H_{13}: There is significant difference between age and weight of pregnant mothers in relation to the birth weight.

Literature review:

Anthony J. Hayter (2002): State that Multiple linear regression model is an extension of a simple linear regression model that allows the response variable y to be modeled as a linear function of more than one input variable x_i.

Considering the problem of modeling a response variable y as a function of k input variables $x_1, x_2, \ldots, x_k$ based upon a data set consisting of the n sets of values

$$y_1, x_{11}, x_{21}, x_{31}, \ldots, x_{k1}$$

$$y_n, x_{1n}, x_{2n}, x_{3n}, \ldots, x_{kn}$$

Thus, y_i is the value taken by the response variable y for the ith observation, which is obtained with values $x_{1i}, x_{2i}, x_{3i}, \ldots, x_{ki}$ of the k input variable $x_1, x_2, x_3, \ldots, x_k$

In multiple linear regressions, the value of the response variable y_i is modeled as

$$y_i = \beta_0 + \beta_1 x_{1i} + \beta_{2i} + \ldots + \beta_k x_{ki} + \varepsilon_i \quad (6.1)$$

Which consists of linear combination $\beta_0 + \beta_1 x_{1i} + \beta_{2i} + \ldots + \beta_k x_{ki} + \varepsilon_i$ of the corresponding values of the input variables together with an error term ε_i, $1 \le i \le n$, are taken to be independent observations from a N (0, σ^2) distribution.

The expected value of the response variable at X= $x_1, x_2, \ldots, x_k$ is

$$E(Y/_x) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k \quad (6.2)$$

For k= 2, the expected values of response variable lie on the plane

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 \quad (6.3)$$

The values of β_0, β_1, and β_2, can be computed using the relations below,

$$\beta_0 = \frac{(\sum x_1 y)(\sum x_2^2) - (\sum x_2 y)(\sum x_1 x_2)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)} \quad (6.4)$$

While,

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$$\beta_1 = \frac{(\sum x_1 y)(\sum x_2^2) - (\sum x_2 y)(\sum x_1 x_2)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)} \quad (6.5)$$

and

$$\beta_2 = \frac{(\sum x_2 y)(\sum x_1) - (\sum x_1 y)(\sum x_1 x_2)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)} \quad (6.6)$$

Where $x_1 = (X_1 - \bar{X}_1)$, $x_2 = (X_2 - \bar{X}_2)$, $y = (Y - \bar{Y})$

Thus, $\sum x_1^2 = \sum (X_1 - \bar{X}_1)^2$,

$\sum x_2^2 = \sum (X_2 - \bar{X}_2)^2$

$\sum y^2 = \sum (Y - \bar{Y})$

$\sum x_1 x_2 = \sum (X_1 - \bar{X})(X_2 - \bar{x}_2)$

$\sum x_1 y = \sum (X_1 - \bar{X}_1)(Y - \bar{Y})$,

$\sum x_2 y = \sum (X_2 - \bar{X})(Y - \bar{Y})$.

Analysis of the fitted model:

The fitted value of the response variable at the data point $x_{1i}, x_{2i}, \ldots, x_{ki}$, is in

Equation (6.1) and the residual is

$$e_i = y_i - \hat{y}_i . \quad (6.7)$$

The sum of squares for error (SSE) is

$$SSE = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2 = \sum_{i=1}^{n} e_i^2 \quad (6.8)$$

The Total Sum of Squares (SST) is

$$SST = \sum_{i=1}^{n} (y_i - \bar{y})^2 \quad (6.9)$$

Equation (6.9) can be decompose as

$$SST = SSR + SSE \quad (6.10)$$

Where the regression Sum of Squares is

$$SSR = \sum_{i=1}^{n} (\hat{y}_i - \bar{y})^2 \quad (6.11)$$

However, the analysis of variance table with k- degrees of freedom for regression and n-k-1 degrees of freedom for error. The p-value in the analysis for variance table is for the null hypothesis, $H_0: \beta_1 = \beta_2 = \ldots\ldots = \beta_k = 0$ with the alternative hypothesis H_1 : atleast one of these β_i is non-zero which has the interpretation that the response variable is not related to any of the k –input variables.

Table 1: Analysis of variance (ANOVA) for multiple linear regressions:

Source	Degrees of freedom (df)	Sum of Squares(SS	Mean Square (MS)	F-Statistics	p- value
Regression	K	SSR	MSR=SSR/K	F=SSE/MSE	$P(F_{k,n-k-1}, >F)$
Error	n-k-1	SSE	MSE=SSE/(n-k-1)		
Total	n-1	SST			

The coefficient of multiple determination R^2= SSE / SST the value of R^2 lies between zero and one and indicates the amount of the total variability in the values of the response variable that accounted for by the fitted regression model.

The F- Statistic in the analysis of the variance table can be written as $F = (n-k-1)R^2/ k (1-R^2)$.

Data Analysis

The data in appendix I was used for the analysis and the analysis was performed considering the hypotheses as stated in section 5. The values of the constants are

β_0 =2.23, β_1 =0.0100, β_2=0.0121.

as in equations (6.4), (6.5) and (6.6) respectively. Thus, the model below was obtained as the multiple linear regression for the research.

$$\hat{y} = 2.23 + 0.0100\, x_1 + 0.0121\, x_2$$

Test of significance concerning multiple regressions:

We shall consider the multiple regression models for two variables of the form:

H_0: $\mu_1 = \mu_2$ vs H_1: $\mu_1 \neq \mu_2$

Then, we shall reject H_0 at significance level α, if the P- value is less than α or when F- calculated value is greater than the F-table value

Table2: Test of significance of Ages of Mothers in relation to the birth weights.

SOURCE	dF	SS	MS	F	P
Regression	1	1.4103	1.4103	4.86	0.030
Error	98	28.4481	0.2903		
Total	99	29.8584			

$\alpha = 0.05$, $F_{table} = F_{1,98,0.05} = 3.84$

From table 1, we shall reject the null hypothesis and accept the alternative that there is significance difference between Ages of Mothers and their birth weights. Since p< 0.05 also $F_{calculated} = 4.86$ is greater than $F_{table} = F_{1,98,0.05} = 3.84$.

Table 3:Test of significance of Weights of Mothers in relation to the birth weights.

SOURCE	dF	SS	MS	F	P
Regression	1	2.6103	2.6103	9.39	0.003
Error	98	27.2481	0.2780		
Total	99	29.8584			

$\alpha = 0.05$, $F_{table} = F_{1,98,0.05} = 3.84$

From table 2. We shall reject the null hypothesis and accept the alternative that there is significance difference between Weights of Mothers and their birth weights. Since p< 0.05 also $F_{calculated} = 9.39$ is greater than $F_{table} = F_{1,98,0.05} = 3.84$

Table 4: Test of significance of Ages and Weights of Mothers in relation to the birth weights.

SOURCE	dF	SS	MS	F	P
Regression	2	2.8614	1.4307	5.14	0.008
Error	97	26.9970	0.2783		
Total	99	29.8584			

$\alpha = 0.05$, $F_{table} = F_{1,97,0.05} = 3.84$

From table 3, we shall reject the null hypothesis and accept the alternative that there is significance difference between Ages and Weights of Mothers in relation to their birth weights. Since p< 0.05 also $F_{calculated} = 5.14$ is greater than $F_{table} = F_{1,97,0.05} = 3.84$.

Conclusion:

Giving birth is an unavoidable life process that promotes population growth and secures the future perpetuation of individual societies. Whether human beings or tiny spiders, all life reproduces in one way or another to create future generations of that particular species.

The results of analysis as extracted from the MINTAB14 output are presented as Appendix2. We tested if there is any correlation between ages and weights of mothers in relation to their birth weights. However, there is a positive correlation of 0.2160 and 0.2950 between ages and weights of mothers in relation to their birth weights respectively. Since the correlation analysis does not indicate the presence of a causal relationship.

We proceed to test the hypothesis whether the mother's ages or the mother's weight is of any statistical significant to the birth weight. For the hypothesis on the significance of age to the birth weight, we observe that the value of F- calculated = 4.86 is greater than F- table = 3.84 at $\alpha = 0.05$ level of significance. Thus, this implies that the null hypothesis will be rejected and conclude that mother's age is relatively important to the birth weight.

The hypothesis whether the mother's weight is of any statistically importance to the birth weight, we observe that the value of F- calculated =9.39 is greater than F-table=3.84 at $\alpha = 0.05$ level of significance. Thus, this implies that the null hypothesis will be rejected and conclude that mother's is relatively significance to the birth weight.

In the same vein, for the hypothesis on the significance of both mother's age and weight to the birth weight, we observe that the F- calculated =5.14 is greater than F-table =3.84 with 0.3098 correlation at $\alpha = 0.05$ level of significance; the null hypothesis is rejected and the alternative hypothesis will be accepted, we conclude that mother's age and weight does effect significantly the birth weight neglecting all other factors that can determine the infacnt birth weight.

We recommend that, early marriage should be discourage especially for young girls under the age of 18 years; Women should stop delaying their marriage and those that have married should stop the habit of delaying their pregnancy till later date. As shown that, fertility decreases in women with age and the chances of given birth to preterm or low birth weight baby is at increase.

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APPENDIX .1

DATA ON MOTHERS AGE AND WEIGHT IN RELATION TO THEIR BIRTH WEIGHT.

S/NO	BIRTH WEIGHT (Y)	MOTHERS AGE (X_1)	MOTHERS WEIGHT (X_2)	S/NO	BIRTH WEIGHT (Y)	MOTHERS AGE (X_1)	MOTHERS WEIGHT (X_2)
1	3.7	30	93.0	51	4.0	29	57.5
2	3.4	27	55.0	52	3.9	27	48.5
3	4.1	25	70.0	53	3.1	26	59.0
4	3.7	32	62.0	54	3.3	24	68.0
5	3.4	24	65.0	55	3.2	25	63.0
6	4.1	29	91.0	56	3.8	35	74.0
7	4.0	28	88.0	57	4.0	23	63.0
8	3.5	25	92.0	58	3.4	30	58.0
9	3.5	25	72.0	59	3.7	26	60.0
10	3.7	28	71.0	60	3.8	22	61.0
11	1.0	21	59.0	61	3.5	30	77.0
12	2.8	26	70.0	62	4.2	20	81.0
13	3.0	24	72.5	63	3.1	30	60.0
14	3.4	20	67.0	64	3.6	40	105.0
15	3.4	28	84.0	65	3.6	20	73.0
16	3.0	17	57.0	66	3.0	20	60.0
17	3.0	24	60 0	67	3.1	18	64.0
18	3.2	20	66.0	68	3.4	22	60.0
19	3.5	27	74.0	69	3.5	20	62.0
20	3.7	30	72.0	70	3.3	23	55.0
21	3.2	29	58.0	71	2.0	23	78.0
22	3.3	27	72.0	72	3.0	25	74.0
23	3.6	32	80.0	73	3.0	30	56.0
24	3.1	20	45.0	74	3.7	32	73.0
25	4.0	28	71.0	75	3.5	20	65.0
26	2.7	20	60.0	76	3.7	34	59.0
27	3.1	30	60.0	77	2.1	34	65.0
28	3.7	28	60.0	78	3.0	40	80.0
29	3.8	32	69.0	79	3.5	31	70.0
30	3.0	25	52.0	80	2.6	23	58.0
31	4.1	35	103.0	81	3.5	31	85.0
32	3.6	20	72.0	82	3.6	19	73.0
33	3.4	20	73.0	83	2.3	20	65.0
34	4.1	22	65.0	84	4.0	27	75.0
35	3.2	18	60.8	85	2.9	25	58.0
36	3.2	22	59.0	86	3.9	30	56.0
37	3.2	26	65.0	87	2.8	20	55.0
38	3.1	25	69.0	88	2.3	32	70.0
39	2.9	18	63.0	89	3.5	30	60.6
40	3.3	20	80.0	90	2.8	20	52.0
41	3.3	22	65.0	91	2.9	35	78.0
42	3.2	23	56.0	92	4.0	22	65.0
43	3.0	25	58.0	93	1.6	25	69.0
44	3.2	20	62.0	94	2.3	17	50.0
45	4.2	25	70.9	95	3.0	28	68.0
46	3.5	34	80.0	96	3.4	45	73.0
47	2.7	20	60.0	97	3.4	20	56.0
48	3.9	35	90.0	98	3.6	20	54.0
49	3.2	20	58.0	99	3.0	34	78.8
50	2.6	22	60.0	100	3.5	29	63.0

SOURCE: GENERAL HOSPITAL, MINNA 2007-2008

APPENDIX 2.

Results for: BIRTH WEIGHT.MTW

Regression Analysis: BIRTH WEIGHT(Y) versus MOTHERS AGE(X1)

The regression equation is
BIRTH WEIGHT(Y) = 2.76 + 0.0211 MOTHERS AGE(X1)

Predictor	Coef	SE Coef	T	P
Constant	2.7586	0.2532	10.89	0.000
MOTHERS AGE(X1)	0.021066	0.009558	2.20	0.030

S = 0.538783 R-Sq = 4.7% R-Sq(adj) = 3.8%

PRESS = 29.5515 R-Sq(pred) = 1.03%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	1.4103	1.4103	4.86	0.030
Residual Error	98	28.4481	0.2903		
Lack of Fit	19	8.8615	0.4664	1.88	0.027
Pure Error	79	19.5867	0.2479		
Total	99	29.8584			

5 rows with no replicates

Unusual Observations

Obs	MOTHERS AGE(X1)	BIRTH WEIGHT(Y)	Fit	SE Fit	Residual	St Resid
11	21.0	1.0000	3.2010	0.0713	-2.2010	-4.12R
64	40.0	3.6000	3.6012	0.1452	-0.0012	-0.00 X
71	23.0	2.0000	3.2431	0.0605	-1.2431	-2.32R
77	34.0	2.1000	3.4748	0.0944	-1.3748	-2.59R
78	40.0	3.0000	3.6012	0.1452	-0.6012	-1.16 X
88	32.0	2.3000	3.4327	0.0795	-1.1327	-2.13R
93	25.0	1.6000	3.2853	0.0545	-1.6853	-3.14R
96	45.0	3.4000	3.7066	0.1904	-0.3066	-0.61 X

R denotes an observation with a large standardized residual.
X denotes an observation whose X value gives it large influence.

Durbin-Watson statistic = 1.90059

No evidence of lack of fit (P >= 0.1).

Regression Analysis: BIRTH WEIGHT(Y) versus MOTHERS WEIGHT(X2)

```
The regression equation is
BIRTH WEIGHT(Y) = 2.33 + 0.0144 MOTHERS WEIGHT(X2)


Predictor                Coef   SE Coef     T      P
Constant               2.3324    0.3215  7.26  0.000
MOTHERS WEIGHT(X2)   0.014442  0.004714  3.06  0.003

S = 0.527297   R-Sq = 8.7%   R-Sq(adj) = 7.8%

PRESS = 28.1748   R-Sq(pred) = 5.64%


Analysis of Variance

Source          DF       SS      MS     F      P
Regression       1   2.6103  2.6103  9.39  0.003
Residual Error  98  27.2481  0.2780
  Lack of Fit   42  10.3166  0.2456  0.81  0.757
  Pure Error    56  16.9316  0.3023
Total           99  29.8584


 26 rows with no replicates


Unusual Observations

        MOTHERS      BIRTH
Obs  WEIGHT(X2)  WEIGHT(Y)     Fit  SE Fit  Residual  St Resid
  1          93     3.7000  3.6755  0.1322    0.0245    0.05 X
 11          59     1.0000  3.1844  0.0656   -2.1844   -4.18R
 31         103     4.1000  3.8199  0.1764    0.2801    0.56 X
 64         105     3.6000  3.8488  0.1855   -0.2488   -0.50 X
 71          78     2.0000  3.4588  0.0730   -1.4588   -2.79R
 77          65     2.1000  3.2711  0.0538   -1.1711   -2.23R
 93          69     1.6000  3.3289  0.0534   -1.7289   -3.30R

R denotes an observation with a large standardized residual.
X denotes an observation whose X value gives it large influence.


Durbin-Watson statistic = 1.90145

No evidence of lack of fit (P >= 0.1).
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Regression Analysis: BIRTH WEIGHT versus MOTHERS AGE(, MOTHERS WEIG

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The regression equation is
BIRTH WEIGHT(Y) = 2.23 + 0.0100 MOTHERS AGE(X1) + 0.0121 MOTHERS WEIGHT(X2)


Predictor                Coef   SE Coef     T      P  VIF
Constant               2.2292    0.3395  6.57  0.000
MOTHERS AGE(X1)       0.01001   0.01054  0.95  0.345  1.3
MOTHERS WEIGHT(X2)   0.012124  0.005310  2.28  0.025  1.3


S = 0.527560   R-Sq = 9.6%   R-Sq(adj) = 7.7%

PRESS = 28.4455   R-Sq(pred) = 4.73%
```

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	2	2.8614	1.4307	5.14	0.008
Residual Error	97	26.9970	0.2783		
Lack of Fit	84	23.8720	0.2842	1.18	0.389
Pure Error	13	3.1250	0.2404		
Total	99	29.8584			

76 rows with no replicates

Source	DF	Seq SS
MOTHERS AGE(X1)	1	1.4103
MOTHERS WEIGHT(X2)	1	1.4511

Unusual Observations

Obs	MOTHERS AGE(X1)	BIRTH WEIGHT(Y)	Fit	SE Fit	Residual	St Resid
11	21.0	1.0000	3.1547	0.0727	-2.1547	-4.12R
31	35.0	4.1000	3.8283	0.1767	0.2717	0.55 X
64	40.0	3.6000	3.9026	0.1940	-0.3026	-0.62 X
71	23.0	2.0000	3.4051	0.0924	-1.4051	-2.71R
77	34.0	2.1000	3.3576	0.1057	-1.2576	-2.43R
88	32.0	2.3000	3.3982	0.0793	-1.0982	-2.11R
93	25.0	1.6000	3.3160	0.0551	-1.7160	-3.27R
96	45.0	3.4000	3.5646	0.1965	-0.1646	-0.34 X

R denotes an observation with a large standardized residual.
X denotes an observation whose X value gives it large influence.

Durbin-Watson statistic = 1.90584

No evidence of lack of fit (P >= 0.1).

Regression Analysis: BIRTH WEIGHT versus MOTHERS AGE(, MOTHERS WEIG

The regression equation is
BIRTH WEIGHT(Y) = 2.23 + 0.0100 MOTHERS AGE(X1) + 0.0121 MOTHERS WEIGHT(X2)

Predictor	Coef	SE Coef	T	P
Constant	2.2292	0.3395	6.57	0.000
MOTHERS AGE(X1)	0.01001	0.01054	0.95	0.345
MOTHERS WEIGHT(X2)	0.012124	0.005310	2.28	0.025

S = 0.527560   R-Sq = 9.6%   R-Sq(adj) = 7.7%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	2	2.8614	1.4307	5.14	0.008
Residual Error	97	26.9970	0.2783		
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Source	DF	Seq SS
MOTHERS AGE(X1)	1	1.4103
MOTHERS WEIGHT(X2)	1	1.4511

Durbin-Watson statistic = 1.90584

No evidence of lack of fit (P >= 0.1)

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Correlations: BIRTH WEIGHT(Y), MOTHERS AGE(X1)

Pearson correlation of BIRTH WEIGHT(Y) and MOTHERS AGE(X1) = 0.217
P-Value = 0.030

Correlations: BIRTH WEIGHT(Y), MOTHERS WEIGHT(X2)

Pearson correlation of BIRTH WEIGHT(Y) and MOTHERS WEIGHT(X2) = 0.296
P-Value = 0.003

Correlations: MOTHERS AGE(X1), BIRTH WEIGHT(Y), MOTHERS WEIGHT(X2)

	MOTHERS AGE(	BIRTH WEIGHT
BIRTH WEIGHT	0.217	
	0.030	
MOTHERS WEIG	0.460	0.296
	0.000	0.003

Cell Contents: Pearson correlation
P-Value

Descriptive Statistics: BIRTH WEIGHT(Y), MOTHERS AGE(X1), MOTHERS WEIGHT(X2)

Variable	Total Count	N	N*	CumN	Percent	CumPct	Mean	SE Mean
BIRTH WEIGHT(Y)	100	100	0	100	100	100	3.3040	0.0549
MOTHERS AGE(X1)	100	100	0	100	100	100	25.890	0.567
MOTHERS WEIGHT(X	100	100	0	100	100	100	67.28	1.12

Variable	StDev	Variance	CoefVar	Sum of Squares	Minimum	Q1	Median
BIRTH WEIGHT(Y)	0.5492	0.3016	16.62	1121.5000	1.0000	3.0000	3.4000
MOTHERS AGE(X1)	5.666	32.099	21.88	70207.000	17.000	20.000	25.000
MOTHERS WEIGHT(X	11.24	126.41	16.71	465147.56	45.00	59.25	65.00

Variable	Q3	Maximum	IQR	Skewness	Kurtosis	MSSD
BIRTH WEIGHT(Y)	3.7000	4.2000	0.7000	-1.19	2.91	0.2929
MOTHERS AGE(X1)	30.000	45.000	10.000	0.73	0.36	32.308
MOTHERS WEIGHT(X	73.00	105.00	13.75	0.99	1.25	124.76

Descriptive Statistics: BIRTH WEIGHT(Y), MOTHERS AGE(X1), MOTHERS WEIGHT(X2)

Variable	Total Count	N	Percent	Mean	SE Mean	StDev	Variance
BIRTH WEIGHT(Y)	100	100	100	3.3040	0.0549	0.5492	0.3016
MOTHERS AGE(X1)	100	100	100	25.890	0.567	5.666	32.099
MOTHERS WEIGHT(X	100	100	100	67.28	1.12	11.24	126.41

Variable	CoefVar	Sum	Sum of Squares	Minimum	Maximum
BIRTH WEIGHT(Y)	16.62	330.4000	1121.5000	1.0000	4.2000
MOTHERS AGE(X1)	21.88	2589.000	70207.000	17.000	45.000
MOTHERS WEIGHT(X	16.71	6727.80	465147.56	45.00	105.00