Title: A BRIEF ANALYSIS AND COMPARATIVE STUDY ON SKILLS OF FIFA Mobile BASE CARDS

Name: SOUHARDYA MITRA

Roll: 459

Supervisor's Name: Prof. PALLABI GHOSH

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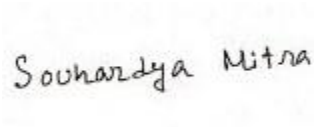
I affirm that I have identified all my sources and that no part of my dissertation paper uses unacknowledged materials.



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SUMMARY:

FIFA Mobile is a football simulation video game. The players available in FIFA Mobile have their profile framed with six main skills. The given skills of each player may be dependent on their physical features i.e. height and weight.

All skills cannot be measured by the physical features. Some exceptional skills can also be developed by practicing and polishing the skill in practice ground.

In this paper, the individual correlation coefficients, partial coefficients, square of multiple correlation coefficients between skills and predictors for different playing positions are measured, where the skills are PACE, ACCURACY (SHOOTING), PASSING, REFLEX (AGILITY), DEFENDING, PHYSICAL and the predictors are HEIGHT IN CM and WEIGHT IN KG.

And besides this, the important skills which are helpful to describe the practically immeasurable skill REFLEX are also found by the partial correlation coefficients between REFLEX and the other skills.

In the light of the given data, except the goalkeeper position, more or less every skill and predictors are moderately correlated and very few skills are absolutely not describable by the predictors. So there is a mixed response from different skills of different positions. And for the skill REFLEX, the predictors are ACCURACY, DEFENDING and PHYSICAL.

KEYWORDS: FIFA Mobile, skill, association, physical features, predictors, R^2 value

CONTENTS:

INTRODUCTION:

FIFA Mobile is a football video game developed by EA Mobile and EA Canada. EA Sports published the game for iOS and Android. 11th October of 2016 was the releasing date of FIFA Mobile for Android and iOS. This is actually a multiplayer video game. This game was **nominated** for the **Satellite Award** for **Outstanding Mobile Game** in the year **2016**. In this game there are two types of mode. First is the attack mode game play or the mode where gamers can play against each other. The second one is event mode, where the gamers can play many seasonal event skill games and can get football players and other necessary things to play the game. By the second mode of game play, gamers collect the players and form a line-up with their favourite players and then they play the attack mode matches with the lineup. FIFA game was available in Windows and PlayStations from 1993. But the mobile version has reached the milestone of 139 million downloads in just only 5 years, which is amazing.

The most interesting fact about FIFA Mobile is that, it has several names i.e. FIFA Soccer, FIFA Mobile Ultimate Team, FIFA Football. The version of the game changes after every year and like real world football, there also starts a new season for gamers after changing the version.

The game provides the gamers more than 17000 players of more than 700 clubs and more than 30 official leagues. The main interesting thing there is each player is given an overall rating (OVR) and 6 main skill ratings. The skills are PACE, ACCURACY (SHOOTING), PASSING, REFLEX (AGILITY), DEFENDING, PHYSICAL. The skill names changes from version to version but the measurement of the six skills is exactly same for each year or the same skill is renamed after each year. The main factor is the skills are assigned to a number varied from 0 to 140. So besides the training ground stats and match stats, is there may be also a factor depending on their physical appearance, according to which FIFA Mobile assign the skills. My interest is

lying on the factor or the motto of the work is to find how the skills of the players and their HEIGHT and WEIGHT is related to each other for the main four positions goalkeeper, defender, midfielder, forward.

METHODOLOGY:

Let us consider p variables as $X_1, X_2 \ldots X_P$.

Suppose information on these p variables is collected on n units.

Let, X_1 is the response and other p-1 variables i.e. $X_2, X_3 \ldots X_P$ are continuous predictors.

Let us define X_{ij}: value of the i^{th} variable for the j^{th} unit for i=1(1)p and j=1(1)n.

Define,

- $\bar{X}_i$ =Mean of the i^{th} variable= $\frac{1}{n} * \sum_{j=1}^{n} X_{ij}$, for all i=1(1)p
- s_{ii}= Variance of the i^{th} variable= $\frac{1}{n} * \sum_{j=1}^{n} (X_{ij} - \bar{X}_i)^2$, for all i= 1(1)p
- s_{ij} = Covariance between X_i and X_j or cov(X_i, X_j)= $\frac{1}{n} * \sum_{k=1}^{n} (X_{ik} - \bar{X}_i) * (X_{jk} - \bar{X}_j)$, for all i= 1(1)p and j= 1(1)n [Note that, $s_{ij} = s_{ji}$]
- r_{ij} = Product moment correlation coefficients of X_i and X_j = $\frac{sij}{\sqrt{sii * sjj}}$, for all i= 1(1)p and j= 1(1)n [Note that, $r_{ii} = 1$ and $r_{ij} = r_{ji}$]
- S= Variance- covariance matrix= $\begin{pmatrix} s_{11} & \cdots & s_{1p} \\ \vdots & \ddots & \vdots \\ s_{p1} & \cdots & s_{pp} \end{pmatrix}$ [Note that, S is a symmetric and positive definite matrix]
- R= Correlation matrix = $\begin{pmatrix} 1 & \cdots & r_{1p} \\ \vdots & \ddots & \vdots \\ r_{p1} & \cdots & 1 \end{pmatrix}$ [Note that, R is a symmetric and positive definite matrix]
- R_{ij}^* = Minor of the $(i,j)^{th}$ element of R

Multiple linear regression of X_1 on $X_2, X_3 \ldots X_p$ is modelled as,

$X_1 = X_{1.23\ldots p} + e_{1.23\ldots p}$, where $X_{1.23\ldots p}$ is the predicted value of X_1 based on the p-1 predictors and $e_{1.23\ldots p}$ is the associated error term.

In the paper, I consider $X_{1.23\ldots p,i} = b_1 + b_2x_{2j} + \ldots + b_px_{pj}$, j=1(1) n

Thus in particular the model is,

$X_{1j} = b_1 + b_2x_{2j} + \ldots + b_px_{pj} + e_{1.23\ldots p,j}$, where b_1, $b_2 \ldots b_p$ are the constants involved in the regression and b_1 is the intercept term of the regression model.

By method of least square, the estimated model is,

- $\hat{X}_{1.23\ldots p,\,j} = \bar{X}_1 - \frac{\sqrt{s11}}{\sqrt{s22}} * \frac{R12}{R11} (X_{2j} - \bar{X}_2) - \ldots - \frac{\sqrt{s11}}{\sqrt{spp}} * \frac{R1p}{R11} (X_{pj} - \bar{X}_p)$ ----------(1)
- $r_{1.23\ldots p}$ = Multiple correlation coefficient = $\sqrt{1 - \frac{|R|}{R11}}$, where |R| is the determinant of the matrix R. ----------(2)
- $R^2 = (r_{1.23\ldots p})^2$ ----------(3)
- $r_{ij.12,\ldots(i-1),(i+1)\ldots(j-1),(j+1),\ \ldots p} = \frac{-Rij}{\sqrt{Rii * Rjj}}$ = partial correlation coefficient between X_i and X_j eliminating the effect of other p-2 variables. ----------(4)

COLLECTION OF DATA:

There is an app, called FIFARenderZ. This app contains all FIFA Mobile player database. In the app we can also upgrade the player's overall rating and skill boost and can see the player's upgraded skills. After upgradation, the player's six main skills are collected at 110 overall rating and 20 skill boost. Generally players can have at most 110 overall rating and 30 skill boost. The addition of these two numbers gives the player a 140 final overall rating (in FIFA this is called OVR) which is maximum for a player. For the year 2021, till January the maximum upgradable skill boost was 20. So the data has been collected on player overall rating 110 and skill boost 20 or players of 130 OVR.

DATA DESCRIPTION:

My collected data is on 544 players of top 50 European clubs of 10 different leagues. I have collected the player's name, club, league, PACE, ACCURACY, PASSING, REFLEX, DEFENDING, PHYSICAL, HEIGHT IN CM and WEIGHT IN KG. All collected skills and predictors are continuous variable.

Every main skill of the six main skills is also divided into sub-skills. Below there is a short description of each skills,

- **PACE:** This skill is actually the measure of the sprint speed and acceleration of a player. The average of these two sub-skills i.e. sprint speed and acceleration.

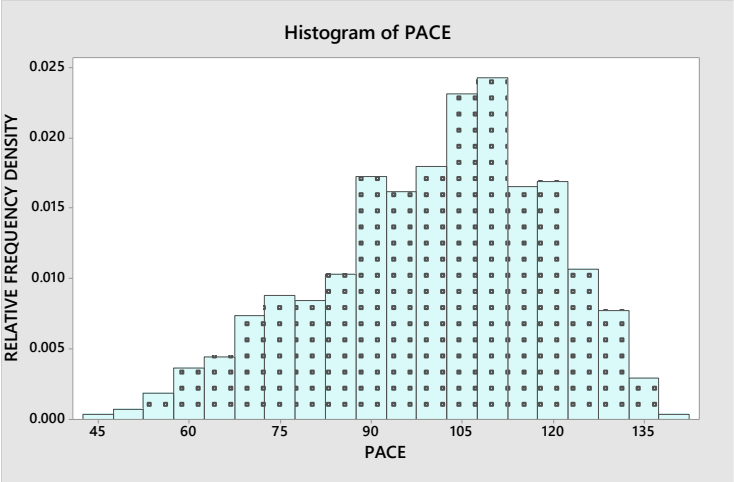


Figure 2

The histogram (Figure 2) represents the relative frequency density of PACE. So, here PACE is negatively skewed.

- **ACCURACY:** This skill is based on the shooting techniques of a player i.e. the positioning, shot power, finishing, long shot, volley and penalty. Average of these sub-skills is expressed as ACCURACY.

From the histogram (Figure 3), it can be seen that ACCURACY is negatively skewed.

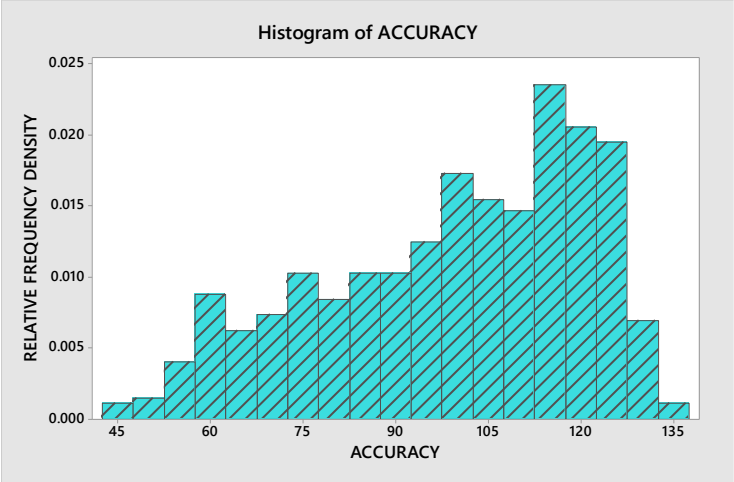


Figure 3

- **PASSING:** This skill is the accumulated measure of a player's crossing, free kick, vision, short passing, long passing, curved passing or curved shooting. Average of these sub-skills is expressed as PASSING.

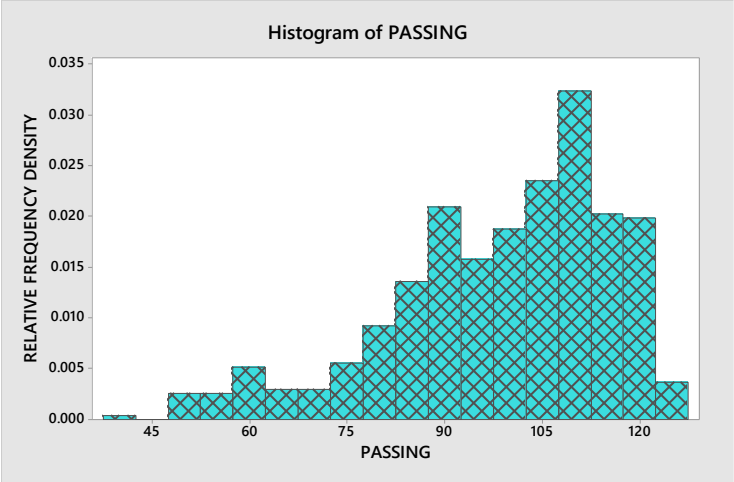


Figure 4

From the histogram (Figure 4), PASSING is negatively skewed.

- **REFLEX:** This skill is all about how much agile the player is. It is a accumulated measure of dribbling, balancing, ball control etc. Average of these sub-skills is expressed as REFLEX.

From the graph (Figure 5), REFLEX is positively skewed. Here coefficient of skewness is 0.04, which is very close to 0. Hence it can be considered that REFLEX is symmetrically distributed.

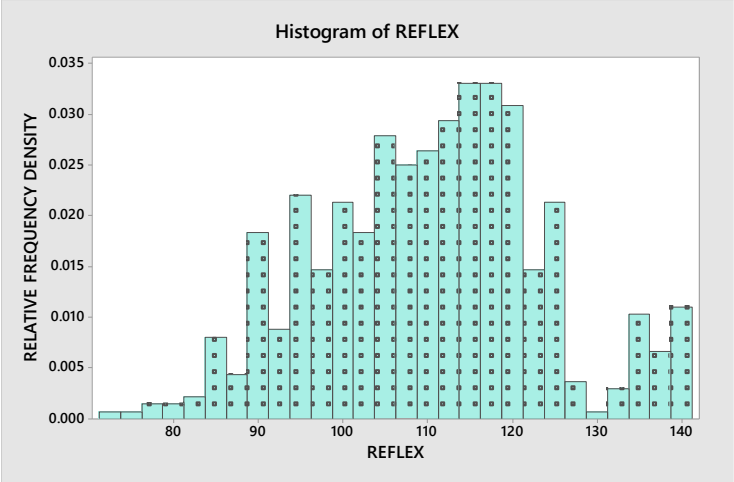


Figure 5

- **DEFENDING:** This is a measure of defensive capability of a player. This skill reflects the capabilities of interceptions, heading, marking, standing tackle and sliding tackle. Average of these sub-skills is expressed as DEFENDING.

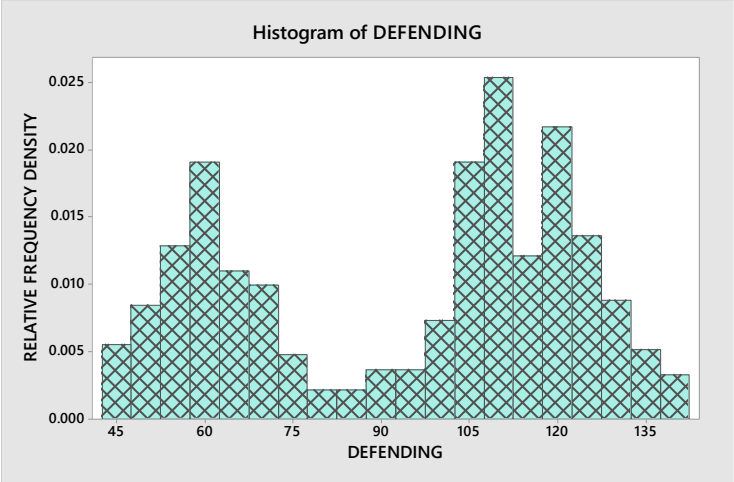


Figure 6

From the histogram (Figure 6), DEFENDING is negatively skewed. Here the coefficient of skewness is -0.31.

- **PHYSICAL:** This skill is a measure of player's physical strength which reflects the player's jumping, strength and aggression. Average of these sub-skills is expressed as PHYSICAL.

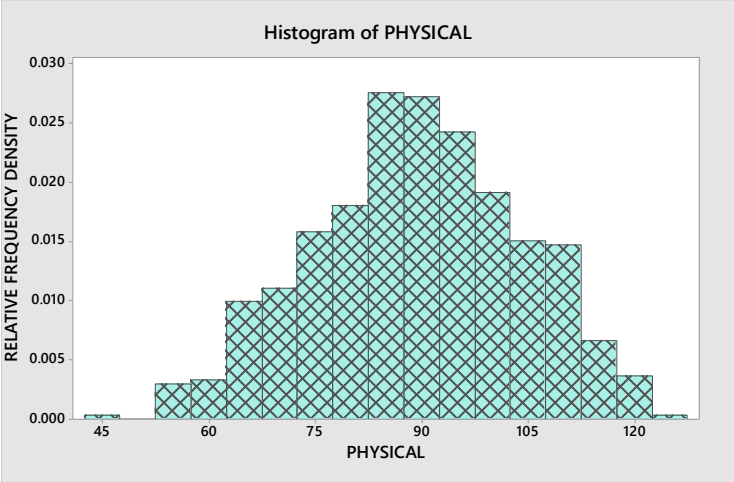


Figure 7

The histogram (Figure 7) shows that PHYSICAL is negatively skewed. As the coefficient of skewness is -0.1, hence PHYSICAL can also be considered as symmetrically distributed.

- HEIGHT IN CM and WEIGHT IN KG are the physical features provided by FIFA Mobile which represents their height and weight in the unit centimetre and kilogram respectively.

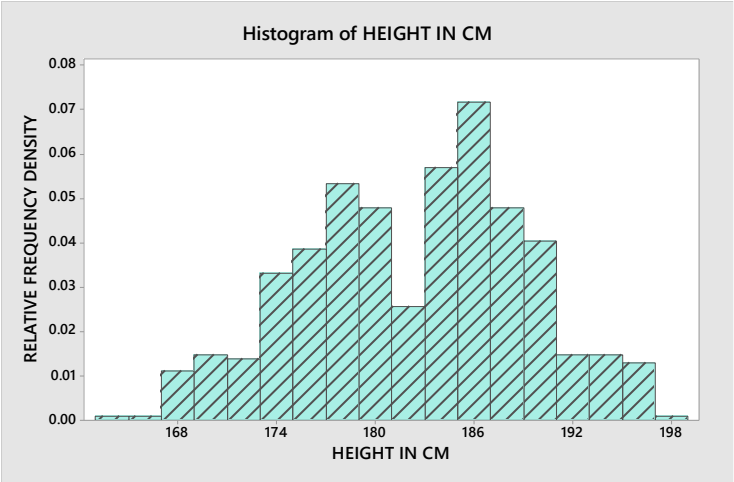


Figure 8

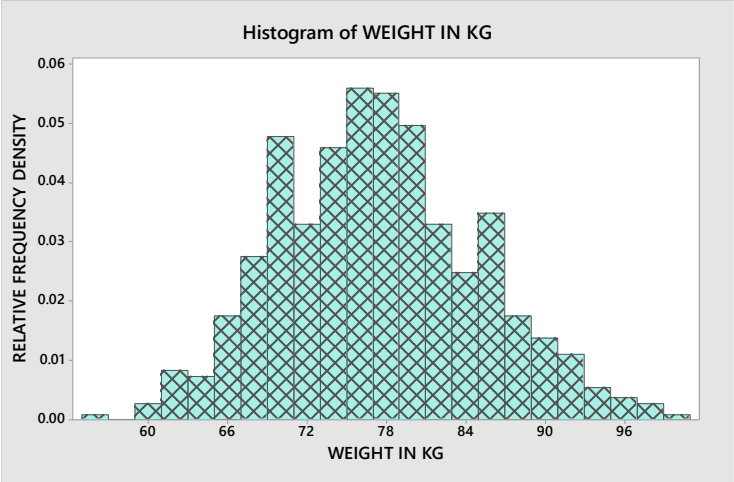


Figure 9

From the histogram (Figure 8), HEIGHT IN CM is negatively skewed and from the histogram (Figure 9), WEIGHT IN KG is positively skewed. Here the coefficient of skewness for HEIGHT IN CM is -0.13, which is very close to zero. Hence HEIGHT IN CM can be considered as symmetrically distributed.

- Now for the position goalkeeper, the skills are assigned in some different ways in FIFA. They are respectively DIVING, POSITIONING, HANDLING, REFLEXES, KICKING and PHYSICAL. But for simplicity in comparison the skills are coded to the main six skills like 'Sprint speed' is one sub-skill of PHYSICAL for the goalkeepers in FIFA Mobile but here I assigned 'sprint speed' as PACE, as for PACE sprint speed is the best suited sub-skill.

The tabular form of coding the data of the skills of goalkeeper is shown below

TABLE 1

SHOWING THE FIFA PROVIDED SKILLS OF GOALKEEPER, SELECTED SUB-SKILLS FOR CODING AND BEST SUITED MAIN SKILLS FOR THE SUB-SKILLS

Goal keeper skill (as given in FIFA Mobile)	Selected sub skill of goal keeper's skill	Best suited main skills for the selected sub skills
PHYSICAL	Sprint speed	PACE
KICKING	Long passing	PASSING
KICKING	GK Kicking	ACCURACY
REFLEX	Reflex	REFLEX
DIVING	GK Diving	DEFENDING
PHYSICAL	Strength	PHYSICAL

Thus for the goalkeeper position the sub-skills i.e. the measures of the skills are assigned as best suited main skill in the data.

OBJECTIVES:

OBJECTIVE 1: Visualization of data on each skill against HEIGHT and WEIGHT by scatterplot and infer about how much the predictors can individually explain each skill by linear regression fit.

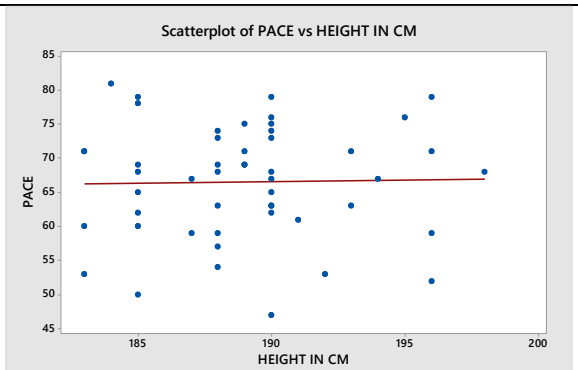
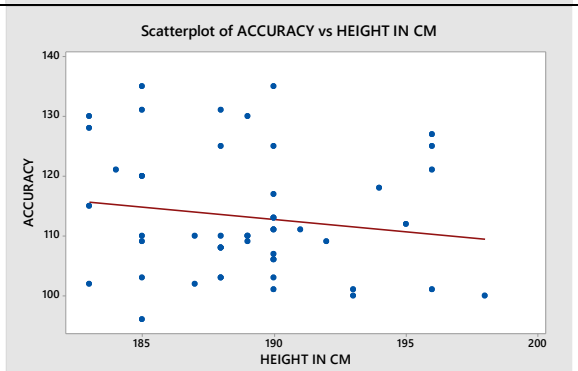
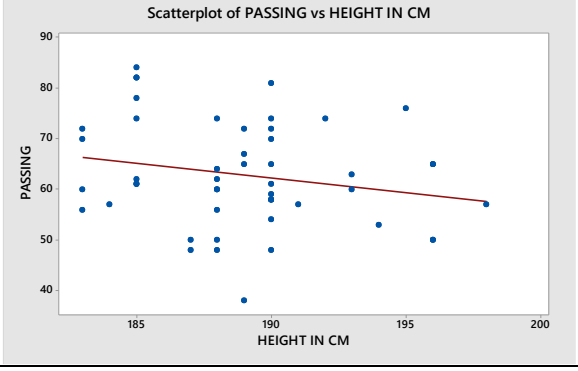
OBJECTIVE 2: To see the simple correlation coefficients, partial correlation coefficients and multiple correlation coefficients for each skills and predictors and infer about how much both the predictors can cumulatively explain the skills.

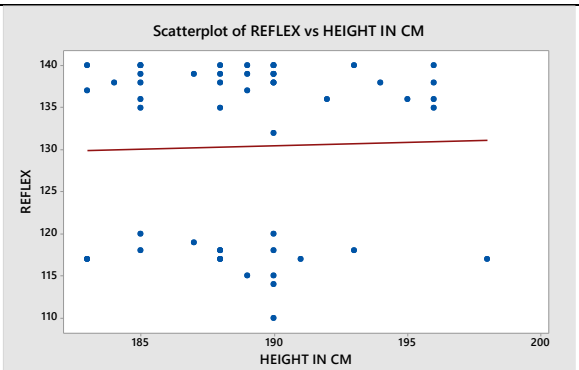
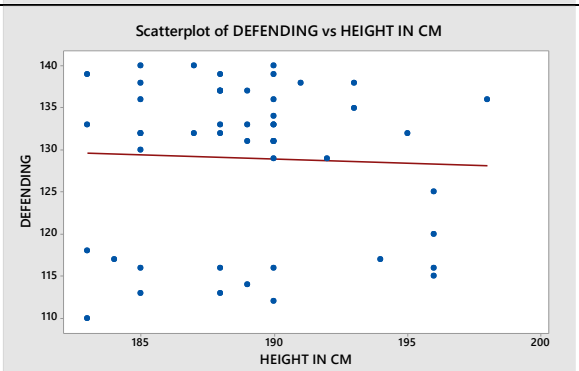
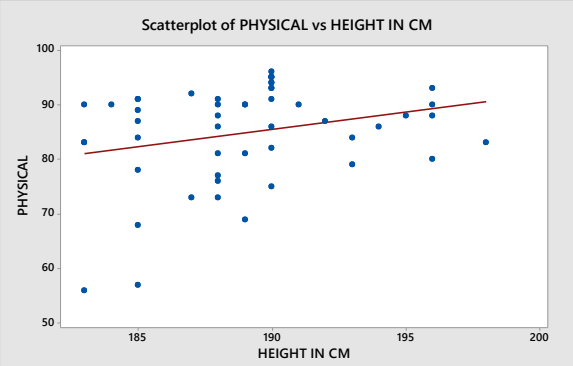
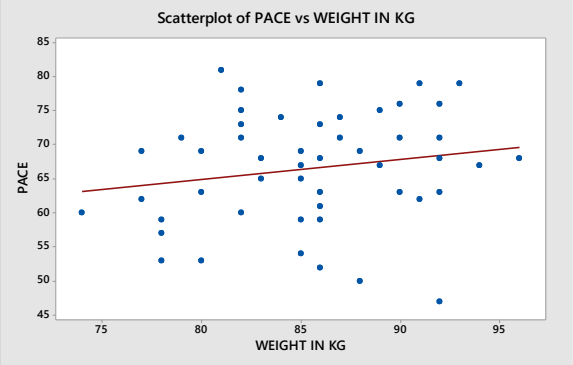
OBJECTIVE 3: To find, how the other skills help in predicting the skill REFLEX (which is not so easily measurable), with the help of a multiple linear regression equation.

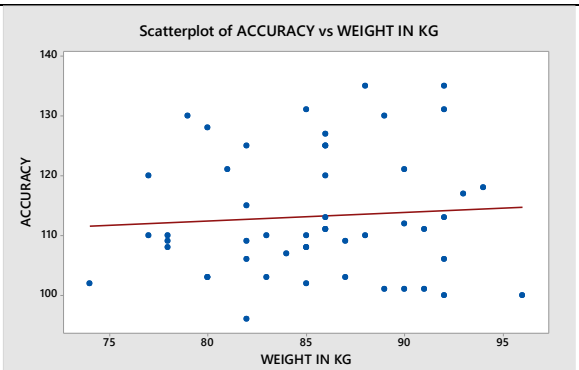
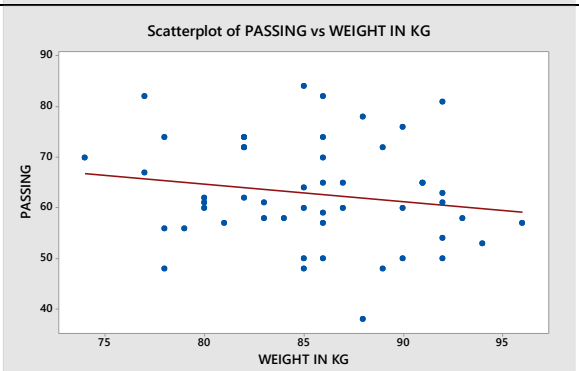
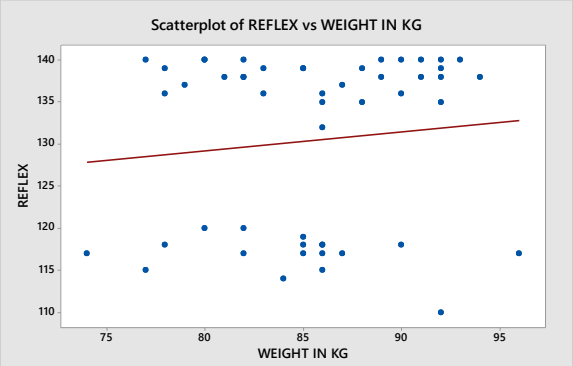
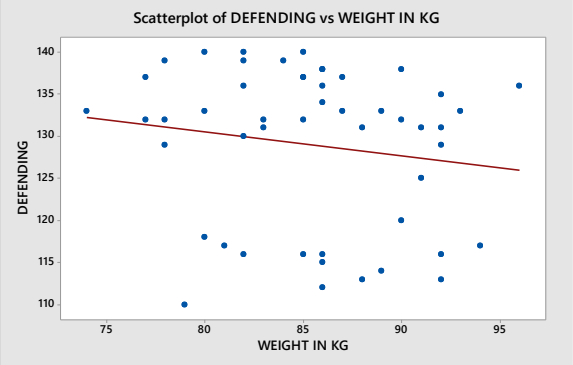
DATA ANALYSIS:

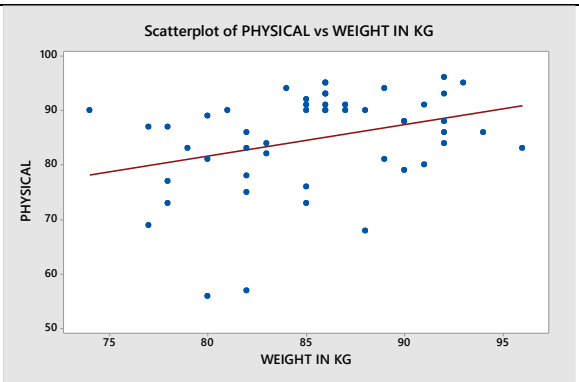
OBJECTIVE 1

- **POSITION**: **GOAL KEEPER** (GK)

SKILL	PREDICTOR	GRAPH	FITTED LINE AND R^2 VALUE	INTERPRETATION
PACE	HEIGHT IN CM		**PACE = 58.2 + 0.044 HEIGHT IN CM** R^2 value= 0.0004088	Here the linear regression model is not showing that height can explain very little amount of pace of goalkeeper, hence for now we can state that for goalkeeper position the height is not at all a good predictor of his pace in FIFA Mobile.
ACCURACY			**ACCURACY = 190.6 - 0.4096 HEIGHT IN CM** R^2 value = 0.02228	Again here the height of a goalkeeper in FIFA Mobile can explain only 2% of the accuracy of the player. Hence here also height is a bad predictor of accuracy for goalkeeper position.
PASSING			**PASSING = 172.0 - 0.5777 HEIGHT IN CM** R^2 value = 0.04508	Here also from the data it seems that for the goalkeeper position HEIGHT is capable of describing only 4.5% of PASSING skill.

REFLEX			**REFLEX = 114.1 + 0.0862 HEIGHT IN CM** R^2 value= 0.001	It seems that HEIGHT can only describe 0.1% of REFLEX of a goalkeeper.
DEFENDING			**DEFENDING = 147.2 - 0.0960 HEIGHT IN CM** R^2 value = 0.00152	HEIGHT of a goalkeeper can describe only 0.1% of the DEFENDING skill.
PHYSICAL			**PHYSICAL = - 35.31 + 0.6356 HEIGHT IN CM** R^2 value =0.07	It seems that HEIGHT of a GK can only describe 7% of his skill PHYSICAL.
PACE	WEIGHT IN KG		**PACE = 41.12 + 0.2973 WEIGHT IN KG** R^2 value= 0.03434	From the data only 3% of PACE of goal keepers can be explained by their WEIGHT.

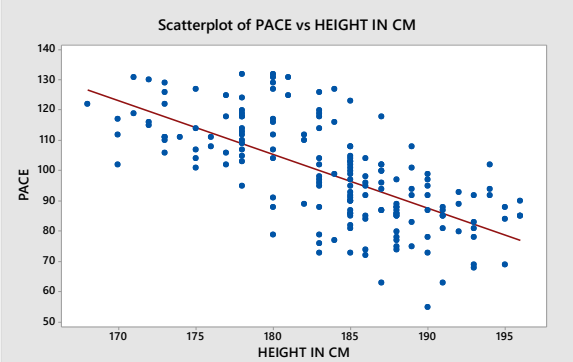
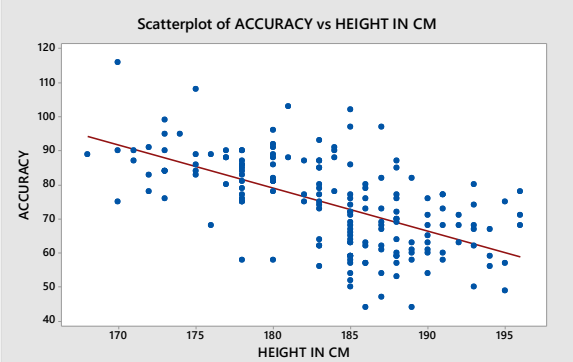
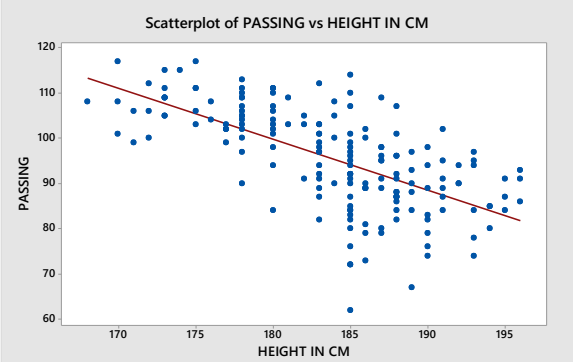
ACCURACY			**ACCURACY = 100.7 + 0.1462 WEIGHT IN KG** R^2 value= 0.00517	Only near about 0.5% of ACCURACY can be explained by the WEIGHT of a goal keeper in FIFA Mobile.
PASSING			**PASSING = 92.69 - 0.3496 WEIGHT IN KG** R^2 value=0.03008	WEIGHT of a goal keeper can explain only 3% of the skill PASSING.
REFLEX			**REFLEX = 111.2 + 0.225 WEIGHT IN KG** R^2 value =0.0123	WEIGHT of a goal keeper can explain only 1% of the REFLEX of a goal keeper in FIFA Mobile.
DEFENDING			**DEFENDING = 153.4 - 0.2855 WEIGHT IN KG** R^2 value=0.02479	WEIGHT of a goal keeper can describe only 2% of the skill DEFENDING.

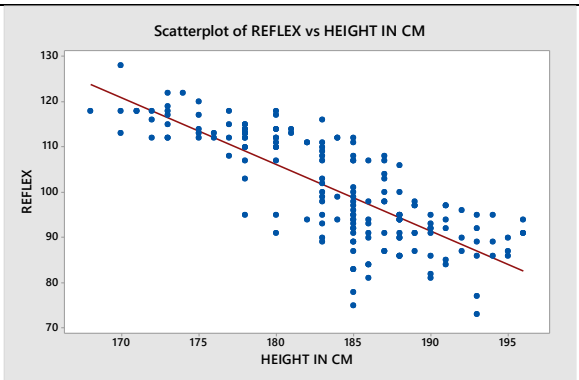
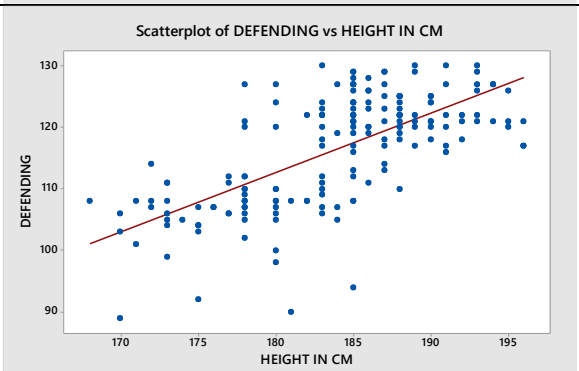
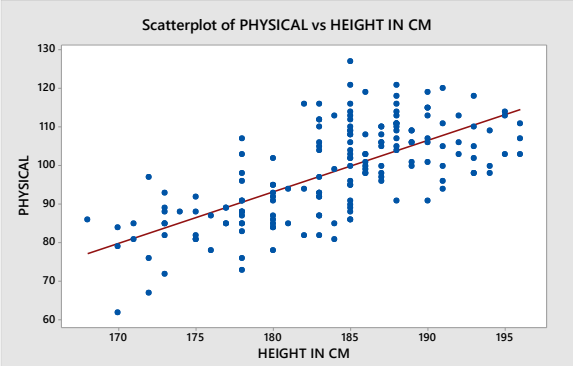
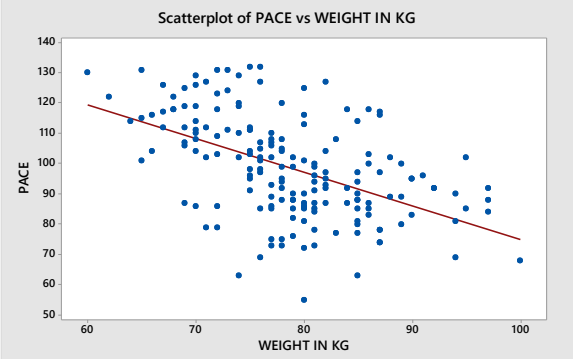
PHYSICAL			**PHYSICAL = 35.43 + 0.5781 WEIGHT IN KG** R^2 value= 0.1061	About 10% of the data on skill, PHYSICAL can be explained by WEIGHT of the goal keeper.

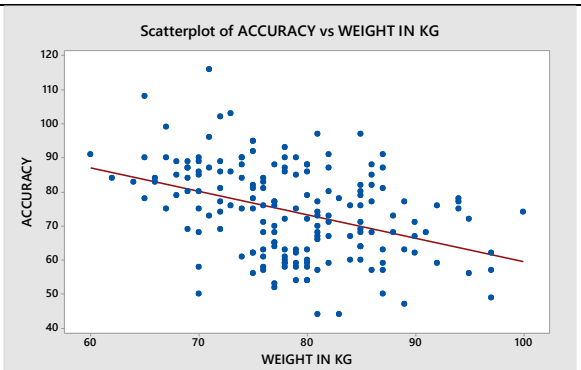
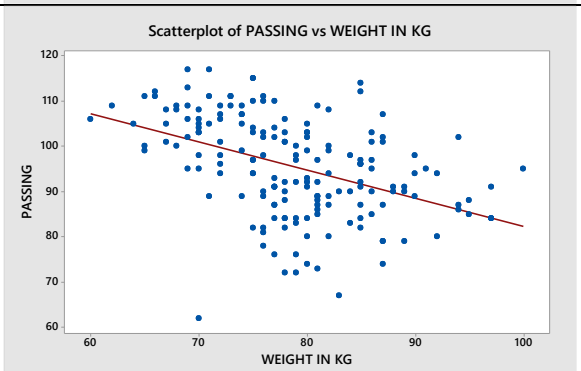
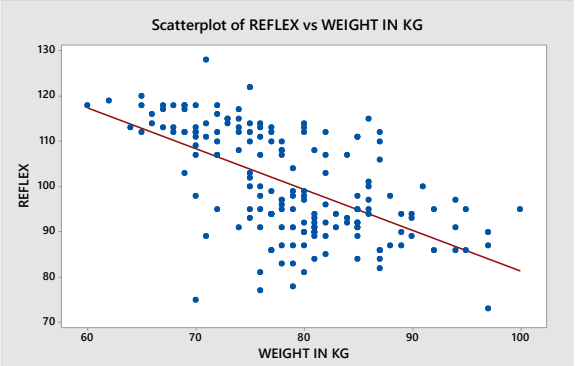
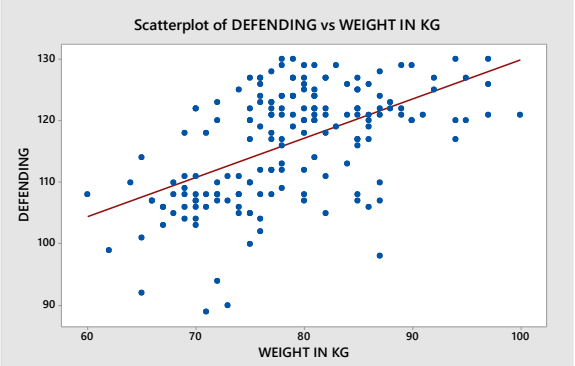
CONCLUSION:

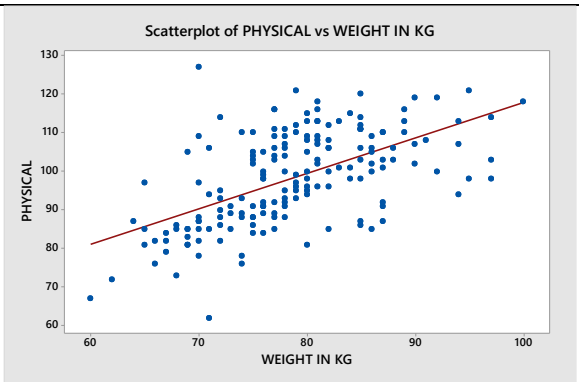
From the data analysis I can see in FIFA Mobile, the goalkeeper position has totally unpredictable skills with respect to their HEIGHT and WEIGHT. In real life football, the HEIGHT of a goalkeeper is very advantageous to them so it was assumed that the HEIGHT could describe the skills REFLEX and DEFENDING of a goalkeeper. But the data analysis is showing us total deviation from the expectation. And from the R^2 values it is evident that HEIGHT as well as WEIGHT failed to describe the skills of goalkeepers in FIFA Mobile. Here from the data description (page no 10 to 13), I can see that the skills are mostly negatively skewed and only two skills are symmetric or skewed with very low coefficient of skewness, hence the linear regression using ordinary least squares (OLS) is showing such vulnerable results for goalkeeper position.

❖ **POSITION**: **DEFENDER (DEF)**

SKILL	PREDICTOR	GRAPH	FITTED LINE AND R^2 VALUE	INTERPRETATION
PACE	HEIGHT IN CM		**PACE = 425.5 - 1.778 HEIGHT IN CM** R^2 value= 0.4504	PACE of a defender can describe 45.04% of its PACE in FIFA Mobile.
ACCURACY			**ACCURACY = 306.0 - 1.261 HEIGHT IN CM** R^2 value= 0.3468	HEIGHT of a defender can explain 34% of his ACCURACY in FIFA Mobile.
PASSING			**PASSING = 301.5 - 1.121 HEIGHT IN CM** R^2 value= 0.4134	HEIGHT of a defender can explain 41.34% of his skill PASSING.

REFLEX			**REFLEX = 371.0 - 1.471 HEIGHT IN CM** R^2 value = 0.6182	HEIGHT of a DEF can explain 61.82% of the skill REFLEX in FIFA Mobile.
DEFENDING			**DEFENDING = - 60.48 + 0.9621 HEIGHT IN CM** R^2 value= 0.4511	45.11% of the skill DEFENDING can be described by the HEIGHT of a defender.
PHYSICAL			**PHYSICAL = - 145.8 + 1.328 HEIGHT IN CM** R^2 value= 0.4668	The HEIGHT of a defender can describe 46.68% of the skill PHYSICAL in FIFA Mobile.
PACE	WEIGHT IN KG		**PACE = 186.3 - 1.113 WEIGHT IN KG** R^2 value= 0.2626	PACE of a defender can be explained to the extent of 26.26% of the HEIGHT.

ACCURACY			**ACCURACY = 128.1 - 0.6846 WEIGHT IN KG** R^2 value= 0.1523	WEIGHT of defender can explain only 15.23% of ACCURACY.
PASSING			**PASSING = 144.4 - 0.6207 WEIGHT IN KG** R^2 value= 0.1889	The WEIGHT of a defender can describe 18.89% of the skill PASSING.
REFLEX			**REFLEX = 171.5 - 0.9010 WEIGHT IN KG** R^2 value= 0.3453	WEIGHT of defender can explain 34.53% of the skill REFLEX in FIFA Mobile.
DEFENDING			**DEFENDING = 66.27 + 0.6366 WEIGHT IN KG** R^2 value= 0.2941	Near about 30% of the skill DEFENDING of defenders can be explained by their HEIGHT in FIFA Mobile.

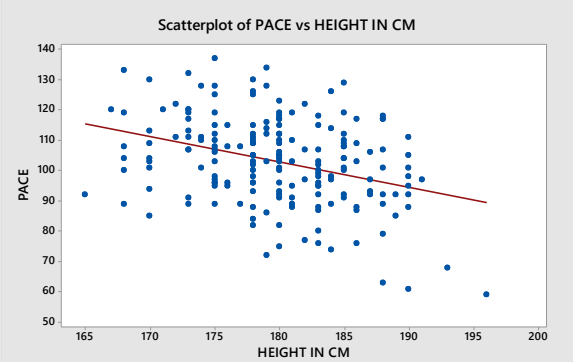
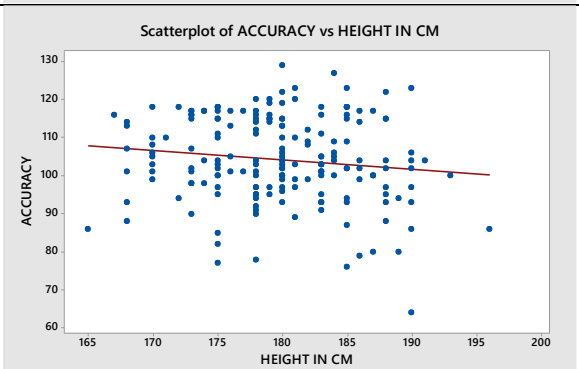
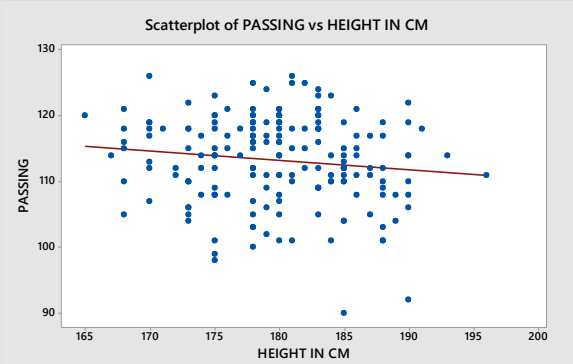
PHYSICAL			**PHYSICAL = 26.08 + 0.9179 WEIGHT IN KG** R^2 value= 0.3322	33.22% of the skill PHYSICAL can be explained by the HEIGHT of defenders in FIFA Mobile.

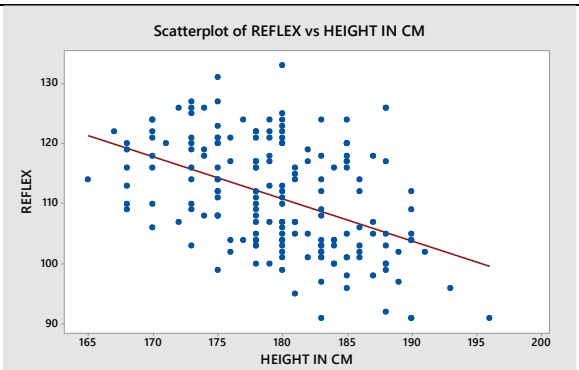
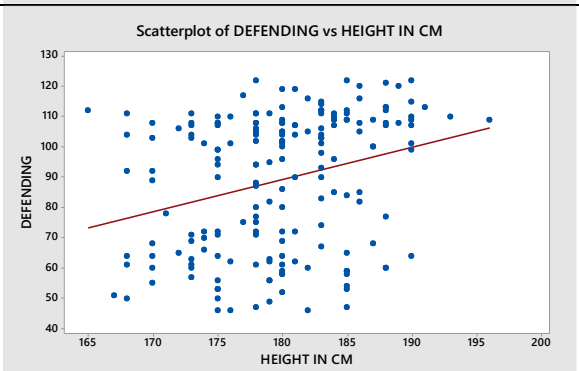
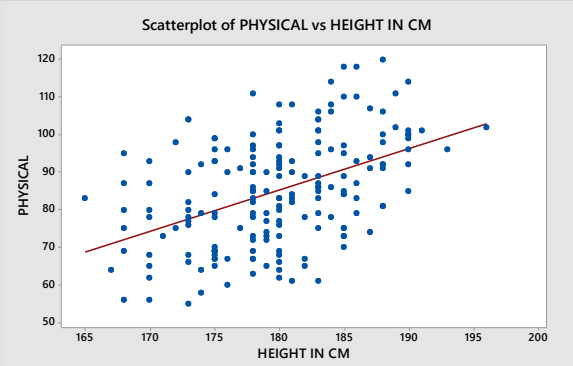
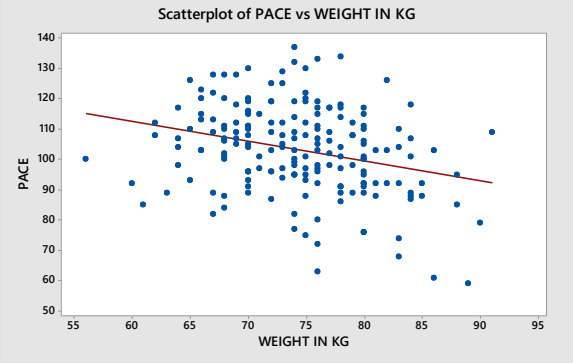
CONCLUSION:

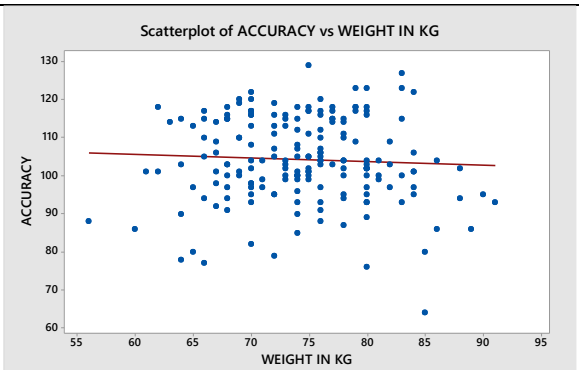
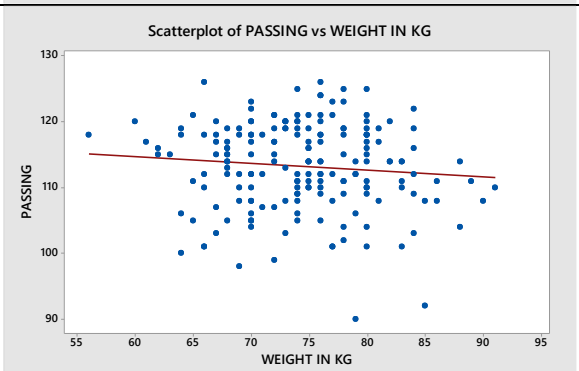
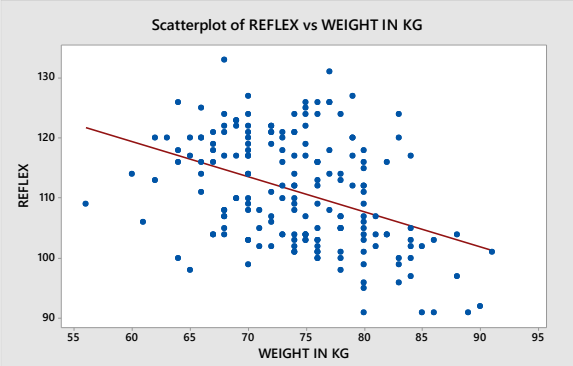
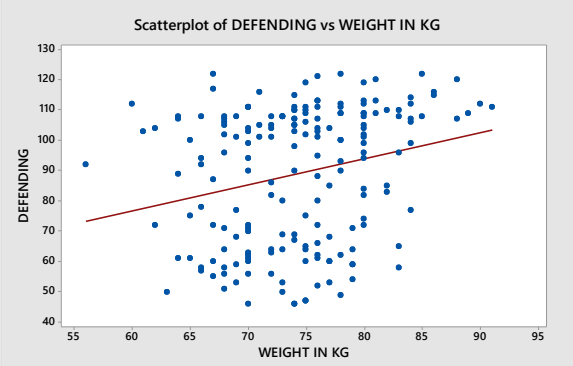
From the data analysis, we can see HEIGHT of defender can describe more than 60% of REFLEX and also able to influence DEFENDING, PASSING, PACE, PHYSICAL with more than 40% accuracy. But as HEIGHT increases PACE, ACCURACY, PASSING, REFLEX decreases i.e. they are negatively correlated with HEIGHT.

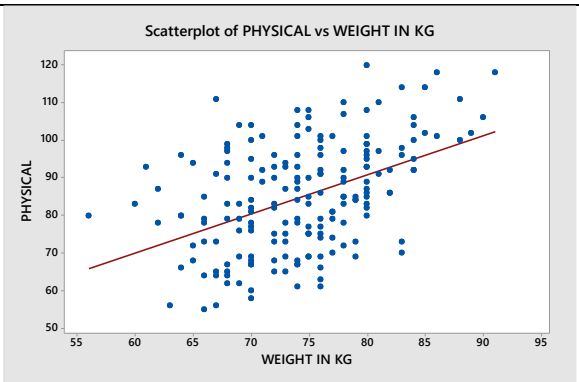
On other hand, WEIGHT of defenders can describe only the skills DEFENDING, PHYSICAL and REFLEX with more or less 30% accuracy. Where REFLEX is negatively correlated with WEIGHT and PHYSICAL and DEFENDING are positively correlated with WEIGHT. For the other skills WEIGHT is unable to describe them with a high percentage. So from the data it seems that REFLEX, PASSING, ACCURACY and PACE of a defender decrease as WEIGHT increases which are valid for real life football too and PHYSICAL and DEFENDING of a defender increase as WEIGHT increases.

❖ **POSITION**: **MIDFIELDER (MID)**

SKILL	PREDICTOR	GRAPH	FITTED LINE AND R^2 VALUE	INTERPRETATION
PACE	HEIGHT IN CM		**PACE = 253.8 - 0.8378 HEIGHT IN CM** R^2 value= 0.119	HEIGHT of midfielder can describe 11.9% of PACE.
ACCURACY			**ACCURACY = 149.2 - 0.2497 HEIGHT IN CM** R^2 value= 0.01788	1.788% of ACCURACY of midfielder can be described by HEIGHT.
PASSING			**PASSING = 138.7 - 0.1414 HEIGHT IN CM** R^2 value= 0.017	1.7% of PASSING can be described by HEIGHT of midfielders.

REFLEX			**REFLEX = 236.6 - 0.6987 HEIGHT IN CM** R^2 value= 0.2069	20.7% of REFLEX of midfielders can be explained by their HEIGHT.
DEFENDING			**DEFENDING = - 103.4 + 1.070 HEIGHT IN CM** R^2 value= 0.08095	8.095% of the skill DEFENDING can be explained by HEIGHT.
PHYSICAL			**PHYSICAL = - 112.6 + 1.099 HEIGHT IN CM** R^2 value= 0.2075	20.75% of PHYSICAL can be explained by HEIGHT of a midfielder.
PACE	WEIGHT IN KG		**PACE = 151.9 - 0.6549 WEIGHT IN KG** R^2 value= 0.08079	8.07% of PACE can be explained by WEIGHT of midfielder.

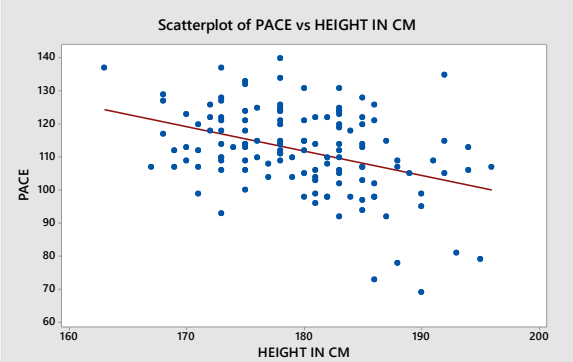
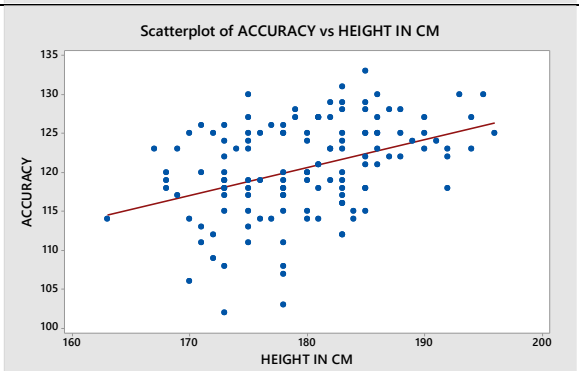
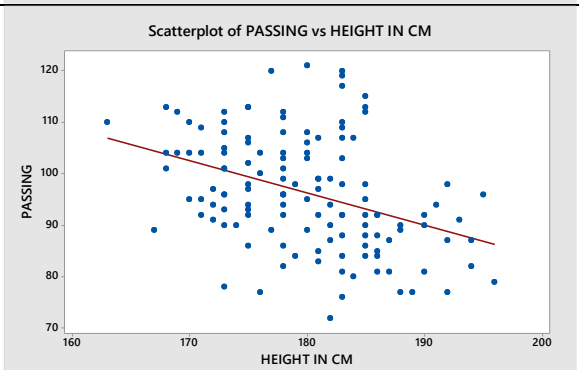
ACCURACY			**ACCURACY = 111.6 - 0.0981 WEIGHT IN KG** R^2 value= 0.003066	0.3% of ACCURACY can be described by WEIGHT of midfielder.
PASSING			**PASSING = 120.8 - 0.1012 WEIGHT IN KG** R^2 value= 0.009391	0.9% of PASSING of midfielder can be described by WEIGHT in FIFA Mobile.
REFLEX			**REFLEX = 154.3 - 0.5828 WEIGHT IN KG** R^2 value= 0.1599	15.99% of REFLEX can be explained by WEIGHT of midfielder in FIFA Mobile.
DEFENDING			**DEFENDING = 24.73 + 0.8655 WEIGHT IN KG** R^2 value= 0.05879	5.87% of DEFENDING of midfielders can be explained by their HEIGHT in FIFA Mobile.

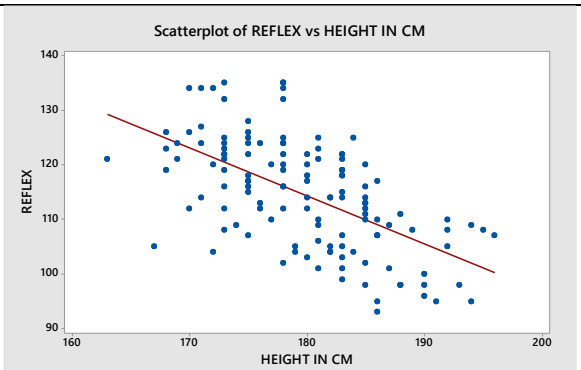
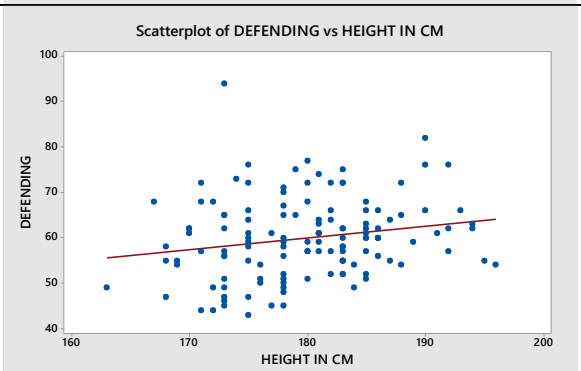
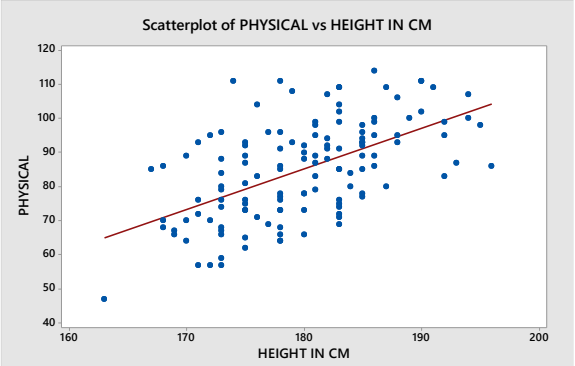
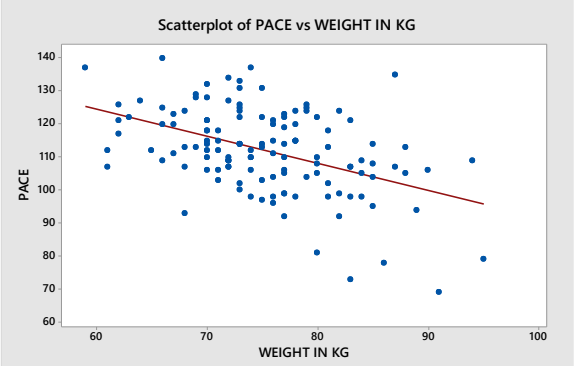
PHYSICAL			**PHYSICAL = 7.62 + 1.041 WEIGHT IN KG** R^2 value= 0.2068	20.68% of PHYSICAL of midfielders can be described by WEIGHT in FIFA Mobile.

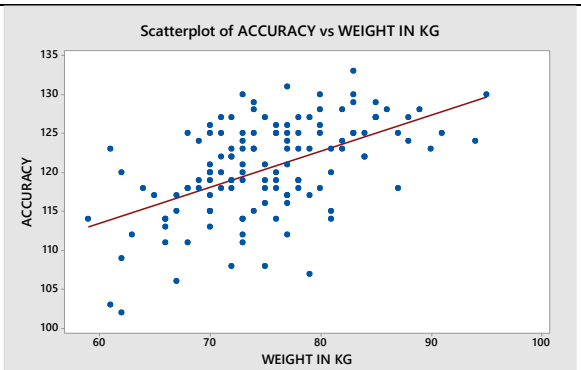
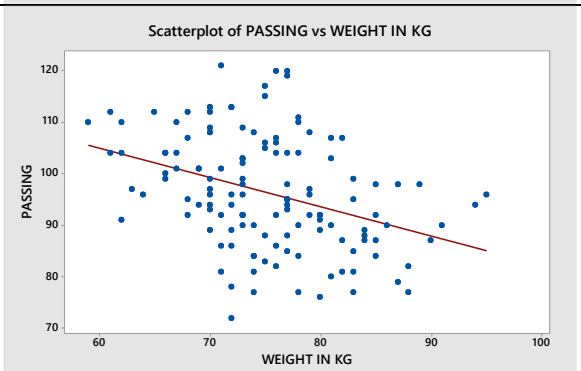
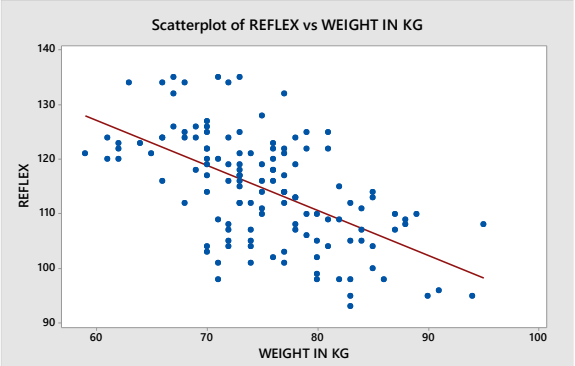
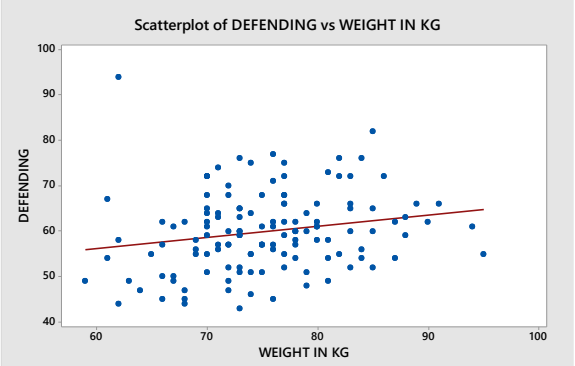
CONCLUSION:

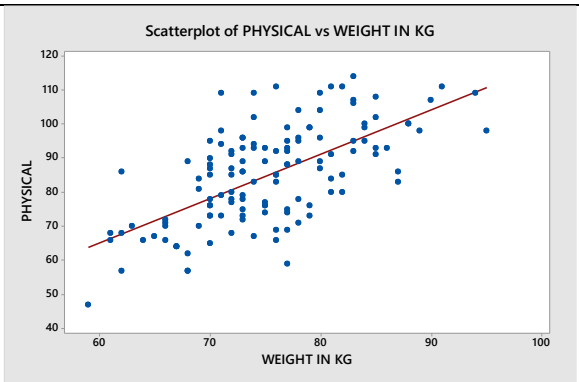
For midfielders in FIFA Mobile, the HEIGHT and WEIGHT are not very effective for their skills, the first interpretation from all above data analysis is midfield is a position where the physicalities is not a decider of gaining the skill, and it also matches with the real life football analysis to some extent. It seems that except REFLEX and PHYSICAL, all other skills can't be explained by HEIGHT of a midfielder in the game. In the two skills PHYSICAL is positively correlated with HEIGHT and REFLEX is negatively correlated with it. Now from the WEIGHT we get the same results as well. PHYSICAL is positively correlated and REFLEX is negatively correlated with WEIGHT and no other skills are explainable by WEIGHT with a percentage greater than 10. Basically in the midfield position the game play is totally based on game knowledge. The successful teams always have a midfield format with good tactics. In real field they are called the game holders so it was expected that the physicalities won't affect their playing pattern.

❖ **POSITION**: **FORWARD (FWD)**

SKILL	PREDICTOR	GRAPH	FITTED LINE AND R^2 VALUE	INTERPRETATION
PACE	HEIGHT IN CM		**PACE = 245.3 - 0.7409 HEIGHT IN CM** R^2 value= 0.1519	15.19% of PACE of forwards in FIFA MOBILE can be explained by their HEIGHT.
ACCURACY			**ACCURACY = 56.10 + 0.3585 HEIGHT IN CM** R^2 value= 0.1558	15.58% of ACCURACY can be described by HEIGHT of forward in FIFA Mobile.
PASSING			**PASSING = 209.0 - 0.6261 HEIGHT IN CM** R^2 value= 0.1466	14.66% of PASSING can be explained by HEIGHT of forward in FIFA Mobile.

REFLEX			**REFLEX = 272.7 - 0.8796 HEIGHT IN CM** R^2 value= 0.3457	34.57% of REFLEX can be explained by HEIGHT of forward in FIFA Mobile.
DEFENDING			**DEFENDING = 13.07 + 0.2607 HEIGHT IN CM** R^2 value= 0.04004	4% of the skill DEFENDING can be explained by HEIGHT of FORWARD.
PHYSICAL			**PHYSICAL = - 129.2 + 1.191 HEIGHT IN CM** R^2 value= 0.3126	31.26% of PJYSICAL can be described by HEIGHT of forward in FIFA Mobile.
PACE	WEIGHT IN KG		**PACE = 174.1 - 0.8236 WEIGHT IN KG** R^2 value= 0.2086	20.86% of PACE of forward can be described by WEIGHT.

ACCURACY			**ACCURACY = 85.74 + 0.4626 WEIGHT IN KG** R^2 value= 0.2883	28.83% of ACCURACY can be explained by WEIGHT of forward in FIFA Mobile.
PASSING			**PASSING = 139.4 - 0.5713 WEIGHT IN KG** R^2 value= 0.1356	13.56% of PASSING can be described by WEIGHT of forward in FIFA Mobile.
REFLEX			**REFLEX = 176.7 - 0.8269 WEIGHT IN KG** R^2 value= 0.3394	33.94% of REFLEX of forward can be explained by his WEIGHT in FIFA Mobile.
DEFENDING			**DEFENDING = 41.19 + 0.2493 WEIGHT IN KG** R^2 value= 0.04067	4.06% of the skill DEFENDING can be explained by WEIGHT of forward in FIFA Mobile.

PHYSICAL			**PHYSICAL = - 12.95 + 1.302 WEIGHT IN KG** R^2 value= 0.4147	41% of the skill PHYSICAL can be described by WEIGHT of forward.

CONCLUSION:

In FIFA Mobile, forward position has players with random HEIGHT and WEIGHT but a similar type of skills.

From the graphs and R^2 values I can infer that HEIGHT of forward can explain their REFLEX and PHYSICAL with more than 30% accuracy. However it is evident that forward with a great HEIGHT is unable to run fast or they seemed to have a very low PACE and from the graph it is evident that HEIGHT and PACE is negatively correlated. PASSING and REFLEX are also negatively correlated with HEIGHT. So HEIGHT of a forward makes him less agile. And as expected the PHYSICAL and DEFENDING skills are positively correlated with HEIGHT.

Now lets us focus on the WEIGHT of forward of the game. Here I can say the boosts PHYSICAL and REFLEX can be explained by more than 30% by WEIGHT of forwards. Also more than 25% of ACCURACY can be explained by WEIGHT of forward. The important thing there is the forwards with more WEIGHT got more ACCURACY which is irrelevant with real world football matches without some exceptional forwards. PHYSICAL and DEFENDING are also positively correlated with WEIGHT, though very few percentages of DEFENDING can be explained by WEIGHT for forwards. PACE, REFLEX and PASSING are negatively correlated with WEIGHT, which is also true for real football fields.

OBJECTIVE 2

From the analysis above, I got some idea about the association of the various skills with each of the predictors HEIGHT and WEIGHT. Now, the question is what the true association between each of the skills and HEIGHT (or, WEIGHT) is, i.e. to measure the association between each of the skills and HEIGHT, eliminating the effect of WEIGHT and vice versa. Also, the association between each of the skills and both the predictors HEIGHT and WEIGHT together is important.

Thus, I have proceeded with the calculation of the required partial correlation coefficients and also the multiple correlation coefficients, which I have presented in a tabular form below.

For this study, responses are PACE, ACCURACY, PASSING, REFLEX, DEFENDING and PHYSICAL, considering one at a time, divided into position. Predictors are HEIGHT (in cm) and WEIGHT (in kg).

Formulae (4), (2) and (3) from methodology are used for obtaining the partial correlation coefficients, the multiple correlation coefficients and the square of multiple correlation coefficients.

[Note that, bivariate regression model and correlation coefficients are a part of multivariate regression model and multiple correlation coefficients]

TABLE 2.1

TABLE SHOWING THE SIMPLE, PARTIAL AND SQUARE OF MULTIPLE CORRELATION COEFFICIENTS CORRESPONDING TO POSITION: GOALKEEPER (GK)

POSITION		**GOALKEEPER**		
SKILL	I \ II	Simple Correlation Coefficient	Partial Correlation Coefficient	Square of Multiple Correlation Coefficient
PACE	Height	0.0202	-0.1210	0.0485
	Weight	0.1853	0.2193	
ACCURACY	Height	-0.1492	-0.2461	0.0654
	Weight	0.0719	0.2100	
PASSING	Height	-0.2123	-0.1360	0.0480
	Weight	-0.1734	-0.0556	
REFLEX	Height	0.0315	-0.0469	0.0145
	Weight	0.1109	0.1162	
DEFENDING	Height	-0.0391	0.0737	0.0299
	Weight	-0.1568	-0.1686	
PHYSICAL	Height	0.2653	0.0871	0.1129
	Weight	0.3258	0.2139	

FOOTNOTE: I → MEASURE; II → PREDICTOR

INTERPRETATION:

1. For the goalkeeper position the skill PACE was positively correlated with HEIGHT but after eliminating the effect of WEIGHT it seems that actually they are negatively correlated and when WEIGHT and HEIGHT both are linearly regressed with PACE it seems that they only can explain only 4.8% of PACE of goal keeper in FIFA Mobile.
2. For ACCURACY of goalkeeper the association between WEIGHT and ACCURACY has significantly increased when I eliminate the effect of HEIGHT.
3. For PASSING the absolute value of both the correlation coefficients decreased when I eliminated the other predictor.

4. For REFLEX, there I also can see that the actually HEIGHT is negatively correlated with REFLEX after eliminating the effect of WEIGHT. And also for the association between WEIGHT and REFLEX there is no contribution of HEIGHT and both HEIGHT and WEIGHT can barely describe about 1.45% of REFLEX.
5. The association between DEFENDING and HEIGHT also changes sign from negative to positive when I eliminate the effect of WEIGHT but the association between WEIGHT and DEFENDING is not at all influenced by the predictor HEIGHT.
6. For the skill PHYSICAL, the association between HEIGHT and PHYSICAL has significantly decreased when I eliminated the effect of WEIGHT, and for WEIGHT, the measure association is also decreased when I eliminate the effect of HEIGHT. After considering both the predictors they can explain only 11.3% of the skill PHYSICAL.

TABLE 2.2

TABLE SHOWING THE SIMPLE, PARTIAL AND SQUARE OF MULTIPLE CORRELATION COEFFICIENTS CORRESPONDING TO POSITION: DEFENDER (DEF)

POSITION		**DEFENDER**		
SKILL	I \ II	Simple Correlation Coefficient	Partial Correlation Coefficient	Square of Multiple Correlation Coefficient
PACE	Height	-0.6709	-0.5046	0.4504
	Weight	-0.5124	-0.0240	
ACCURACY	Height	-0.5889	-0.4857	0.3522
	Weight	-0.3902	0.0914	
PASSING	Height	-0.6430	-0.5314	0.4180
	Weight	-0.4347	0.0884	
REFLEX	Height	-0.7862	-0.6456	0.6182
	Weight	-0.5876	-0.0023	
DEFENDING	Height	0.6716	0.4773	0.4549
	Weight	0.5423	0.0834	
PHYSICAL	Height	0.6832	0.4654	0.4768
	Weight	0.5763	0.1368	

FOOTNOTE: I → MEASURE; II → PREDICTOR

INTERPRETATION:

1. For the skill PACE, the absolute value of the association between PACE and WEIGHT is decreased very much after elimination of the effect of HEIGHT. 45.04% of PACE can be described by both the predictors in a multivariate linear regression model.
2. After eliminating the effect of HEIGHT, the association between WEIGHT and ACCURACY has been changed in positive from negative. Also there is a significant change in the absolute value of correlation coefficients after the elimination of effect of HEIGHT.

3. For PASSING there is no significant change for the association between the skill and HEIGHT, after elimination of the effect of WEIGHT. Though PASSING was negatively associated with WEIGHT, after elimination of HEIGHT it is showing a positive association and the absolute value of the partial correlation coefficient is very low for WEIGHT and PASSING.
4. The absolute value of partial correlation coefficient between REFLEX and WEIGHT is significantly less than the normal correlation coefficient. A major portion i.e. nearly 62% of REFLEX can be explained by both HEIGHT and WEIGHT for the position defender in FIFA Mobile.
5. Both the partial correlation coefficients of HEIGHT and WEIGHT with DEFENDING have decreased with respect to the individual correlation coefficients, but for WEIGHT, the fall of the correlation coefficient after eliminating the effect of HEIGHT is very much prominent. So it seems that HEIGHT took a big role in the association between WEIGHT and DEFENDING.
6. For PHYSICAL also both the partial correlation coefficients of HEIGHT and WEIGHT with PHYSICAL have decreased with respect to the individual correlation coefficients, but for WEIGHT, the fall of the correlation coefficient after elimination of the effect of HEIGHT is very much significant. So it seems that HEIGHT influences the association between WEIGHT and PHYSICAL in a large scale. Accumulation of both the predictors can describe about 48% of the skill PHYSICAL.

TABLE 2.3

TABLE SHOWING THE SIMPLE, PARTIAL AND SQUARE OF MULTIPLE CORRELATION COEFFICIENTS CORRESPONDING TO POSITION: MIDFIELDER (MID)

POSITION		**MIDFIELDER**		
SKILL	I \ II	Simple Correlation Coefficient	Partial Correlation Coefficient	Square of Multiple Correlation Coefficient
PACE	Height	-0.3450	-0.2116	0.1219
	Weight	-0.2842	-0.0576	
ACCURACY	Height	-0.1337	-0.1348	0.0212
	Weight	-0.0554	0.0579	
PASSING	Height	-0.1284	-0.0850	0.0166
	Weight	-0.0969	-0.0075	
REFLEX	Height	-0.4548	-0.2637	0.2184
	Weight	-0.3999	-0.1205	
DEFENDING	Height	0.2845	0.1640	0.0841
	Weight	0.2425	0.0585	
PHYSICAL	Height	0.4554	0.2096	0.2417
	Weight	0.4547	0.2078	

FOOTNOTE: I → MEASURE; II → PREDICTOR

INTERPRETATION:

1. For the midfielder position, both the absolute values of individual correlation coefficients have reduced but the reduction is stronger for the correlation between WEIGHT and PACE. So it can be said that HEIGHT strongly influences the association between WEIGHT and PACE. Though from the R^2 value of multiple correlation coefficient, it can be said that both of the predictors can explain only about 12.19% of the skill PACE.
2. For the association between HEIGHT and ACCURACY, there is no effect of WEIGHT as there is no significant change in individual and partial correlation coefficients. But for the association between WEIGHT and ACCURACY of midfielders, when HEIGHT was allowed to keep its effect they were positively correlated but after eliminating the effect of HEIGHT they comes out

to be negatively correlated with having almost same absolute value of correlation coefficient. Both of the predictors together can describe only 2.12% of the skill ACCURACY.

3. There is no significant change in sign or the values for the correlation coefficients of PASSING and the two predictors. Also from the R^2 value of multivariate regression, I can say that only 2% of PASSING can be explained by the physicalities.
4. For REFLEX, both the individual correlation coefficients have reduced significantly when the influence of the other predictor was eliminated. So both of the predictors was highly influencing the other's individual association with the skill REFLEX. 21.84% of REFLEX can be described by accumulating the two predictors.
5. The influence of HEIGHT in the association between WEIGHT and DEFENDING is greater than the influence of WEIGHT in the association between HEIGHT and DEFENDING. But for both of the predictors the measure of association has been reduced significantly when the influence of the other predictor was eliminated. Accumulation of both the predictors can only describe 8.41% of DEFENDING.
6. In the case of the skill PHYSICAL, for both the predictors the individual correlation coefficients has reduced by equal amount when the influence of other predictor was eliminated. It may be interpreted as the rate of influence of HEIGHT in the association between WEIGHT and PHYSICAL is same as the rate of influence of WEIGHT in the association between HEIGHT and PHYSICAL.

❖ *TABLE 2.4*

TABLE SHOWING THE SIMPLE, PARTIAL AND SQUARE OF MULTIPLE CORRELATION COEFFICIENTS CORRESPONDING TO POSITION: FORWARD (FWD)

POSITION		**FORWARD**		
SKILL	I \ II	Simple Correlation Coefficient	Partial Correlation Coefficient	Square of Multiple Correlation Coefficient
PACE	Height	-0.3898	-0.0727	0.2128
	Weight	-0.4567	-0.2679	
ACCURACY	Height	0.3947	-0.0260	0.2888
	Weight	0.5369	0.3969	
PASSING	Height	-0.3829	-0.1700	0.1606
	Weight	-0.3682	-0.1280	
REFLEX	Height	-0.5879	-0.2739	0.3889
	Weight	-0.5825	-0.2571	
DEFENDING	Height	0.2001	0.0733	0.0458
	Weight	0.2017	0.0776	
PHYSICAL	Height	0.5591	0.1384	0.4259
	Weight	0.6440	0.4061	

FOOTNOTE: I → MEASURE; II → PREDICTOR

INTERPRETATION:

1. For the position forward, both the correlation coefficients for two predictors reduced when the effect of other predictor was eliminated, but the reduction of correlation coefficient of the predictor HEIGHT and PACE is more significant. This may be interpreted as the individual correlation coefficient between HEIGHT and PACE is greatly influenced by WEIGHT.
2. The absolute value of correlation coefficients between HEIGHT, WEIGHT and ACCURACY reduced when I eliminated the effect of WEIGHT and HEIGHT respectively. But before eliminating effect of WEIGHT, HEIGHT and ACCURACY was positively correlated and after eliminating the effect of WEIGHT they seemed to be negatively correlated with a very small

absolute value of correlation coefficient. This indicates a very big influence of WEIGHT in the correlation between HEIGHT and ACCURACY.

3. Both the absolute values of measure of association between HEIGHT, WEIGHT and PASSING has reduced after the eliminating the effect of other predictor. But accumulation of both the predictors can explain only 16.06% of PASSING.
4. Both the absolute values of measure of association between HEIGHT, WEIGHT and REFLEX has reduced after the eliminating the effect of other predictor. But accumulation of both the predictors can explain only 38.89% of REFLEX.
5. Both the values of measure of association between HEIGHT, WEIGHT and DEFENDING has reduced equally after the eliminating the effect of other predictor. But accumulation of both the predictors can explain only 4.58% of DEFENDING.
6. For the skill PHYSICAL, both the absolute values of measure of association between HEIGHT, WEIGHT and the skill has reduced after the eliminating the effect of other predictor. But the reduction of correlation coefficient of the predictor HEIGHT and PHYSICAL is more significant. This may be interpreted as the individual correlation coefficient between HEIGHT and PHYSICAL is greatly influenced by WEIGHT. Accumulation of both the predictors can explain only 42.59% of PHYSICAL which is quiet high compared to other skills.

CONCLUSION:

It is to be noted that for the position DEFENDER, each of the six skills show significant decrease in magnitude of partial correlation coefficient with the predictor WEIGHT when compared with their simple correlation coefficient. Thus, the predictor HEIGHT seems to affect the WEIGHT of a defender to quite an extent. Also, for the other three positions, viz. GOALKEEPER, MIDFIELDER and FORWARD, few of the skills show the same as above. However, it is to be

noted that, for the position GOALKEEPER, the true association between the skill ACCURACY and the predictor WEIGHT is significantly higher than their simple correlation coefficient, also indicating an influence of HEIGHT on the WEIGHT of a goalkeeper, when it comes to his accuracy. Thus, HEIGHT seems to influence WEIGHT in general.

OBJECTIVE 3

In the data, the measurement of the various skills can be done in different ways as follows:

1. PACE: It is usually measured by tracking the speed of player by mathematical calculations of time and distance or by fit band or by speedometer.
2. ACCURACY: Here ACCURACY is a measure of perfect shooting of a soccer player, it can be obtained by observing how many balls he can put on target out of some given opportunities.
3. PASSING: In a match how many passes one has given and how many chances is been created by him is used to measure the PASSING skill.
4. REFLEX: How much agile a player is, denoted by his skill, REFLEX. In fact the skill is a bit difficult to measure.
5. DEFENDING: How many passes of opponent has been blocked by a player and how many tackles won in a match can be considered for measurement of the skill DEFENDING.
6. PHYSICAL: It is a skill which is measured in training ground by fit band and other gym accessories like weight lifting performance.

So from the above description, it is clear that in real life the skill REFLEX is difficult to measure, so I have used partial correlation coefficients to see among the other five skills which skill or skills are more likely to describe REFLEX well in FIFA MOBILE.

- TABULATED REPRESENTATION OF THE PARTIAL CORRELATION COEFFICIENTS

RESPONSE → REFLEX

PREDICTORS → PACE, ACCURACY, PASSING, DEFENDING, PHYSICAL

TABLE 3.1

TABLE SHOWING CORRELATION BETWEEN REFLEX AND EACH OF THE OTHER PREDICTORS (i.e. of the form r_{ij})

PREDICTOR → RESPONSE ↓	**PACE**	**ACCURACY**	**PASSING**	**DEFENDING**	**PHYSICAL**
REFLEX	0.20007	0.64996	-0.01469	-0.37289	-0.71286

From the above table, the magnitude of correlation between REFLEX and PHYSICAL is the maximum and moderately high; hence I consider PHYSICAL as one of the predictors in predicting the skill REFLEX.

TABLE 3.2

TABLE SHOWING PARTIAL CORRELATION BETWEEN REFLEX AND THE PREDICTORS MENTIONED IN THE TABLE, ELIMINATING THE EFFECT OF PHYSICAL (i.e. of the form $r_{ij.k}$)

PREDICTOR → RESPONSE ↓	**PACE**	**ACCURACY**	**PASSING**	**DEFENDING**
REFLEX	-0.10603	0.48709	-0.32956	0.01712

From the above table, the magnitude of partial correlation between REFLEX and ACCURACY eliminating the effect of PHYSICAL is the maximum and moderate; hence I consider ACCURACY along with PHYSICAL as the predictors in predicting the skill REFLEX.

TABLE 3.3

TABLE SHOWING PARTIAL CORRELATION BETWEEN REFLEX AND THE PREDICTORS MENTIONED IN THE TABLE, ELIMINATING THE EFFECTS OF PHYSICAL AND ACCURACY (i.e. of the form $r_{ij.kl}$)

PREDICTOR → RESPONSE ↓	**PACE**	**PASSING**	**DEFENDING**
REFLEX	-0.1384	-0.33515	0.41813

From the above table, the magnitude of partial correlation between REFLEX and DEFENDING eliminating the effects of PHYSICAL and ACCURACY is the maximum and moderately high; hence I consider DEFENDING along with PHYSICAL and ACCURACY as the predictors in predicting the skill REFLEX.

TABLE 3.4

TABLE SHOWING PARTIAL CORRELATION BETWEEN REFLEX AND THE PREDICTORS MENTIONED IN THE TABLE, ELIMINATING THE EFFECTS OF PHYSICAL, ACCURACY AND DEFENDING (i.e. of the form $r_{ij.klm}$)

PREDICTOR → RESPONSE ↓	**PACE**	**PASSING**
REFLEX	0.194917	-0.2294798

Now, from TABLE 3.4, clearly both the partial correlation coefficients have magnitude close to 0.2. So I have checked the values of R^2 once considering PHYSICAL, DEFENDING, and ACCURACY as the predictors and then considering PHYSICAL, DEFENDING, ACCURACY and PASSING as the predictors involved in predicting the response REFLEX by a multivariate linear regression model.

TABLE 3.5

TABLE SHOWING R^2 VALUES OF TWO CASES

CASE 1: RESPONSE→REFLEX, PREDICTORS→ACCURACY, DEFENDING, PHYSICAL

CASE2: RESPONSE→REFLEX, PREDICTORS→ACCURACY, PASSING, DEFENDING, PHYSICAL

CASE	RESPONSE	PREDICTORS	R^2 VALUE
1	REFLEX	ACCURACY, DEFENDING, PHYSICAL	0.6905
2	REFLEX	ACCURACY, PASSING, DEFENDING, PHYSICAL	0.7068

From TABLE 3.5, clearly there is no significant difference between the two R^2 values.

Hence, I consider the predictors in case 1 are effective to explain the response REFLEX.

The multiple linear regression equation is=>

REFLEX = 106.27740 + 0.37656 ACCURACY + 0.17769 DEFENDING - 0.56229 PHYSICAL

INTERPRETATION:

Hence the predictors are ACCURACY, DEFENDING, PHYSICAL which can explain 69.05% of the skill REFLEX.

CONCLUSION:

REFLEX can be measured by the three skills ACCURACY, DEFENDING, PHYSICAL. From the result we can say that agility of a player is dependent on his shooting accuracy, defending

skills and physical strength. These three skills can describe 69.05% of the skill REFLEX in FIFA Mobile. In real field passing strategies or the skill PASSING should also be a good predictor of REFLEX of a player but here the study indicates that the skill hasn't any impact on REFLEX.

LIMITATION OF THE STUDY:

The skills of goalkeeper are not taken exactly as given in FIFA Mobile, instead of the skills, I have taken the sub-skills. That maybe a crucial reason for the biased result of the association between skills and the physical features for the goalkeepers.

Here from the data description (page no 10 to 13), I can see that the skills are mostly negatively skewed and only two skills are symmetric or skewed with very low coefficient of skewness, hence the linear regression using ordinary least squares (OLS) is showing such vulnerable results for goalkeeper position and midfielder position.

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(Data is collected and compiled from the application)

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