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## Efficient Market Hypothesis on Selected Healthcare Stocks Using Run Test

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### ABSTRACT

Efficiency of stock market attracts investors for their investment. An Efficient Market indicates the accuracy of stock prices without bargains in the stock market. In other words, an efficient market conveys the market price of a share that is an unbiased estimate of its intrinsic value. Efficient Market Hypothesis extracts fair market value of stock prices. The present study examines the randomness of the price movements of the selected six Healthcare stocks at Bombay Stock Exchange and determined the efficiency of the stocks using Runs test includes observed runs, upper limit and lower limit. The data on closing prices has been retrieved for three months from January to March 2020. The study has been tested null and alternate hypothesis from the retrieved upper and lower limit and observed runs for six healthcare stocks. The study highlights that the selected healthcare stocks were at weak form efficiency and null hypothesis is accepted.

**KEYWORDS:** Efficient Market Hypothesis, Bombay Stock Exchange, Runs Test, Weak Form, Intrinsic Value

### INTRODUCTION

The Efficient Market Hypothesis (EMH) is the investment theory proposed by Eugene Fama in the 1970s. It notes that security prices completely reflect all available information based on variety of factors such as business filings, business announcement, company dividend policy, firm dynamics and changes in government policy etc. Jensen (1978) gave one of the famous definitions of EMH. He says " The market is productive with regard to the information provided because it is difficult to make economic gains by selling on the basis of the information provided."

If stock market is said to be efficient, it means that the prices of the securities represent their real value. The market shall integrate all knowledge into the prices of securities in a rapid and impartial manner. Evolution of the EMH Initially, the idea of market efficiency emerged in the 19th century. It reached its academic maturity in the 1980s, but

since then it has declined in popularity and empiric validity. Similar ideas to random walking theory have been expressed in the 17th–18th centuries. At the end of the 19th century, the economic terms of effective market theory were established. According to De Moor, Van den Bossche and Verheyden (2013), the founder of effective market theory was G. Gibson. In 1889, he published a book on the London, Paris and New York Stock Exchanges, arguing that stock prices reflect the views of the smartest market participants. There are three variants of the efficient market hypothesis viz., Weak or Random walk theory, Semi strong efficiency, Strong form efficiency.

Weak Form Efficiency the details of market data and information can be retrieved from past/previous stock prices, volume of stocks traded. Suppose the markets are identified an efficient at weak form, Profits are not dependent on technical trading rules on a consistent basis. In turn, with respect to Semi Strong Form Efficiency information available to public viz., Annual report of company and past prices of stocks as well as and macro-economic factors viz., inflation, unemployment so on are incorporated into current prices of stocks. However, in Strong Form Efficiency, the prices of stock reflect all kinds of Private and Public information of the company. The combination of public and private information is incorporated into current prices. Hence, it implies that, the management of the company cannot make the profit from inside information or the company cannot take the advantage of inside affairs or strategies to beat the stock market.

Random walk theory has been likened to the EMH, as both theories agree it is impossible to outperform the market. However, EMH argues that this is because all of the available information will already be priced into the stock's price, rather than that markets are disorganized in any way. Hence, the present study becomes relevant to conduct to know the performance of service sector like healthcare stocks selected from Bombay Stock Exchange (BSE).

## **STATEMENT OF THE PROBLEM**

The present study explains the valid rationale of the investor's investment by knowing the stock prices whether at weak, semi-strong and strong forms and to check how the past prices will affect the company's current share prices. The EMH believes that all investors interpret all available information exactly the same way. Since investors value stocks differently in the way to determine the worth of the stock price in an efficient market. No single investor with the same amount of invested funds can ever attain greater profitability than another if one investor is gets profits another investors will not. There are few research found on the EMH but limited on healthcare sector. However, the knowledge stock market and stock prices and different forms play's a vital role in the recognition of company by an investors. Hence, the present study becomes relevant to analyze the performance and its form with the selected healthcare stocks under service sector from BSE.

## NEED OF THE STUDY

The stock listed in BSE are selected for testing a weak form of efficient market hypothesis, provide valuable insight into the randomness of stock prices prevailing on the BSE and the existence of any significant difference between past security prices and future security prices. With this relationship, investors can determine whether it is worthwhile to analyze past stocks before investing in them. The extent of BSE markets efficiency or inefficiency also determines how useful potential stock to potential investors.

## OBJECTIVES OF THE STUDY

- To identify the relationship between past and future prices of the selected Healthcare stocks listed at BSE.
- To recognize the randomness of the price movements of the selected Healthcare stocks listed at BSE.
- To determine the efficiency of the Healthcare stocks using Runs test.

## LITERATURE REVIEW

**Sharma and Mahendru (2009)**, a study inspected the weak form efficiency of 11 BSE securities using weekly closing values from July 2007 to October 2007 using run test analysis and auto-correlation tests. The study reasoned that BSE is in weak form of efficient and stock prices have very little impact on future prices, which implies that a speculator cannot acquire any advantage by analyzing past qualities.

**Gupta and Gedam (2014)**, the researcher examine for vulnerable form of 'Efficient Market Hypothesis' the usage of last stock charges of numerous IT & automobiles, are selected from 'NSE' listed companies. To find market efficiency run test is used, this study showed Indian market efficiency is in weakly efficient. As a result, seven companies out of eight follow random walks and are effective in weak form.

**Chavannavar and Patel (2016)**, the researcher studied BSE 50 Stocks for the period of 3 months. They have used autocorrelation tests and run tests in order to examine weak form of efficiency and residual return on event study was conducted to check the semi strong form of market efficiency. The stocks are efficient in both weak form and semi strong form.

**Patel, Rajpal and Modi (2018)**, investigation made on Indian securities exchange tried the day by day progressive value changes of Bombay Stock trade SENSEX from first April 2015 to 31st March 2018 with run test. They reasoned that progressive value changes of BSE Sensex during the period are autonomous, and the market can be outflanked, consequently not efficient in weak structure.

## RESEARCH GAP

After going through literature review, it's found that fewer studies are available on EMH particular to service sector. Therefore, the present study is an attempt to exhibit weak form or Semi strong form or strong form situation on respective stocks.

## HYPOTHESIS OF THE STUDY

Null hypothesis ( $H_0$ ): The stocks observed runs, upper limit and lower limit are independent

Alternative hypothesis ( $H_1$ ): The stocks observed runs, upper limit and lower limit are dependent

## RESEARCH DESIGN

The research is descriptive and analytical in nature. The source of data has been retrieved on closing price of selected six healthcare companies listed at BSE. The closing prices has been retrieved for three months from January to March 2020 and has been analyzed using run test and tested on hypothesis.

## SAMPLING TECHNIQUES

The present study employs convenience sampling, non-probability sampling techniques in the selection of healthcare companies from service sector.

## SAMPLE SIZE

The sample size for the present study has been considered as six healthcare stocks from service sector listed at BSE.

## STATISTICAL TOOLS AND TECHNIQUES

**RUN TEST:** Run test is a nonparametric statistical test that finds a hypothesis of randomness for a two valued series of data. The randomness of this distribution can be calculated by taking the data in the specified order and labeling the data having a positive shift with '+' sign and '-' Sign the data that has a negative change. To test the autonomy of the stock prices includes: observation of number of runs: (r), Number of positive runs ( $n_1$ ), Number of negative runs ( $n_2$ ), ' $N_1+n_2$  is Number of observation in each category,

**Mean,  $\mu$ :**  $[(2n_1n_2) / (n_1 + n_2)] + 1$

**Standard deviation,  $\sigma$ :**  $\sqrt{2n_1n_2(2n_1n_2 - n_1 - n_2) / (n_1+n_2)^2 (n_1+n_2-1)}$

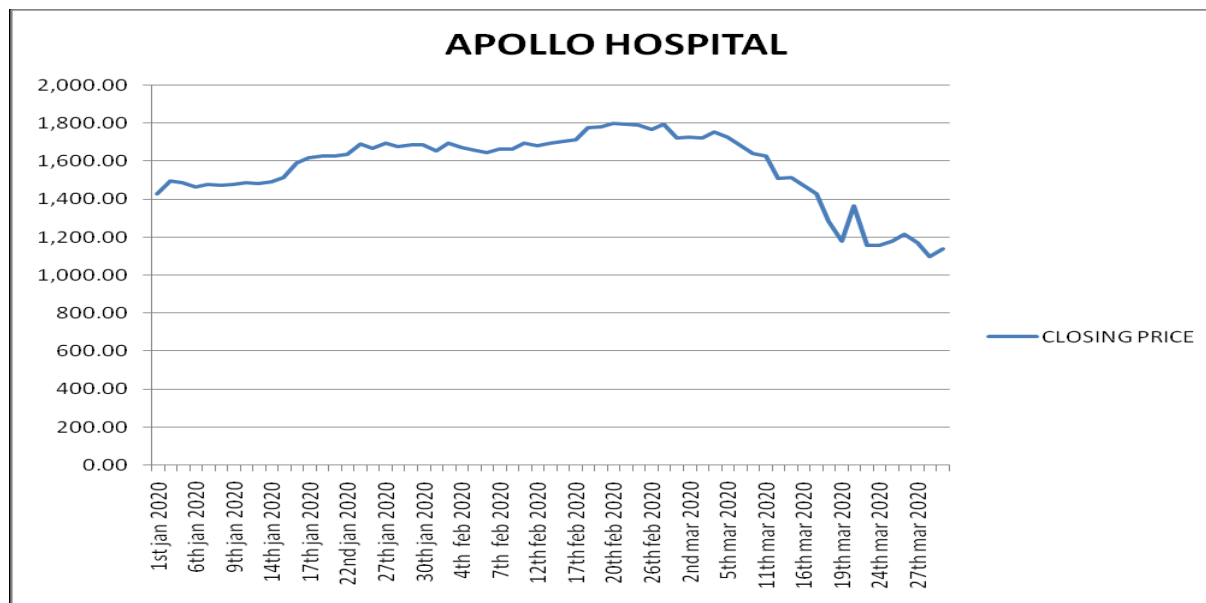
**Level of significance:** To test the weak form of efficiency of the securities exchange, the Runs Test is applied at 5% level of significance where  $z=1.96$

**Lower limit=**  $\{\mu - 1.96 * (\sigma)\}$  or  $\mu - 1.96 * \text{standard deviation}$

**Upper limit=**  $\{\mu + 1.96 * (\sigma)\}$  or  $\mu + 1.96 * \text{standard deviation}$

## A. DATA ANALYSIS ON THE CLOSING PRICE OF APOLLO HOSPITALS FOR THREE MONTHS

Date	Closing	Price	Date	Closing	Price Change
1 <sup>st</sup> Jan 2020	1426.9		18 <sup>th</sup> Feb 2020	1775.35	+
2 <sup>nd</sup> Jan 2020	1494.65	+	19 <sup>th</sup> Feb 2020	1781.25	+
3 <sup>rd</sup> Jan 2020	1486.10	-	20 <sup>th</sup> Feb 2020	1800.15	+
6 <sup>th</sup> Jan 2020	1462.3	-	24 <sup>th</sup> Feb 2020	1795.75	-
7 <sup>th</sup> Jan 2020	1478.25	+	25 <sup>th</sup> Feb 2020	1791.95	-
8 <sup>th</sup> Jan 2020	1474.4	-	26 <sup>th</sup> Feb 2020	1768.9	-
9 <sup>th</sup> Jan 2020	1479.7	+	27 <sup>th</sup> Feb 2020	1797.05	+
10 <sup>th</sup> Jan 2020	1485.0	+	28 <sup>th</sup> Feb 2020	1722.2	-
13 <sup>th</sup> Jan 2020	1482.05	-	2 <sup>nd</sup> Mar 2020	1727.65	+
14 <sup>th</sup> Jan 2020	1493.35	+	3 <sup>rd</sup> Mar 2020	1723.95	-
15 <sup>th</sup> Jan 2020	1512.7	+	4 <sup>th</sup> Mar 2020	1754.05	+
16 <sup>th</sup> Jan 2020	1592.5	+	5 <sup>th</sup> Mar 2020	1728.8	-
17 <sup>th</sup> Jan 2020	1619.15	+	6 <sup>th</sup> Mar 2020	1688.35	-
20 <sup>th</sup> Jan 2020	1629.0	+	9 <sup>th</sup> Mar 2020	1640.45	-
21 <sup>st</sup> Jan 2020	1626.2	-	11 <sup>th</sup> Mar 2020	1627.35	-
22 <sup>nd</sup> Jan 2020	1635.1	+	12 <sup>th</sup> Mar 2020	1508.35	-
23 <sup>rd</sup> Jan 2020	1690.1	+	13 <sup>th</sup> Mar 2020	1513.15	+
24 <sup>th</sup> Jan 2020	1669.15	-	16 <sup>th</sup> Mar 2020	1473.1	-
27 <sup>th</sup> Jan 2020	1697.25	+	17 <sup>th</sup> Mar 2020	1427.8	-
28 <sup>th</sup> Jan 2020	1678.35	-	18 <sup>th</sup> Mar 2020	1283.6	-
29 <sup>th</sup> Jan 2020	1688.6	+	19 <sup>th</sup> Mar 2020	1178.6	-
30 <sup>th</sup> Jan 2020	1687.25	-	20 <sup>th</sup> Mar 2020	1363.95	+
1 <sup>st</sup> Feb 2020	1654.65	-	23 <sup>rd</sup> Mar 2020	1157.9	-
3 <sup>rd</sup> Feb 2020	1696.5	+	24 <sup>th</sup> Mar 2020	1154.65	-
4 <sup>th</sup> Feb 2020	1671.8	-	25 <sup>th</sup> Mar 2020	1179.0	+
5 <sup>th</sup> Feb 2020	1657.9	-	26 <sup>th</sup> Mar 2020	1216.0	+
6 <sup>th</sup> Feb 2020	1644.8	-	27 <sup>th</sup> Mar 2020	1167.7	-
7 <sup>th</sup> Feb 2020	1663.5	+	30 <sup>th</sup> Mar 2020	1096.9	-
10 <sup>th</sup> Feb 2020	1665.8	+	31 <sup>st</sup> Mar 2020	1137.85	+
11 <sup>th</sup> Feb 2020	1697.95	+			
12 <sup>th</sup> Feb 2020	1684.0	-			
13 <sup>th</sup> Feb 2020	1696.85	+			
14 <sup>th</sup> Feb 2020	1703.7	+			
17 <sup>th</sup> Feb 2020	1715.2	+			



### CALCULATION ON APOLLO HOSPITALS

Total runs (r) = 33

Number of positive runs (n1) = 31

Number of negative runs (n2) = 31

Mean ( $\mu$ ) = 32

Standard deviation ( $\sigma$ ) = 3.90

Upper limit= 39.64

Lower limit= 24.35

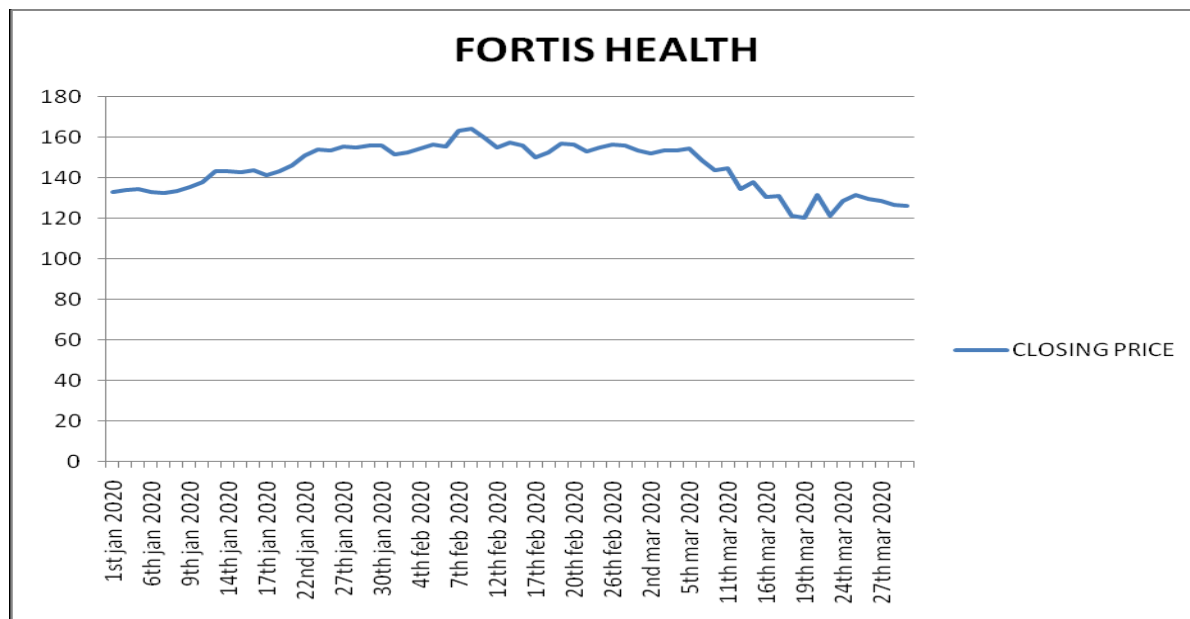
Hence, The applied no of runs 33, where upper limit is 39.64 and lower limit is 24.35.

**INTERPRETATION:** From the above table and graph, the study infers that in the month of January and February more number of positive changes in closing price but in the month of March more number of negative changes in closing price. Consequently, as the quantity of runs observed falls inside the upper and lower limits, it can be reasoned that prices are independent at a 5 % level of significance. Hence, null hypothesis,  $H_0$  is accepted. Therefore, the market on Apollo is weakly efficient.

**B. DATA ANALYSIS ON THE CLOSING PRICE OF FORTIS HEALTH FOR THREE MONTHS**

Date	Closing Price	Price Change	Date	Closing Price	Price Change
1 <sup>st</sup> Jan 2020	133.1		18 <sup>th</sup> Feb 2020	152.7	+
2 <sup>nd</sup> Jan 2020	134.3	+	19 <sup>th</sup> Feb 2020	157.2	+
3 <sup>rd</sup> Jan 2020	134.35	+	20 <sup>th</sup> Feb 2020	156.5	-
6 <sup>th</sup> Jan 2020	133.0	-	24 <sup>th</sup> Feb 2020	153.3	-
7 <sup>th</sup> Jan 2020	132.85	-	25 <sup>th</sup> Feb 2020	154.95	+
8 <sup>th</sup> Jan 2020	133.55	+	26 <sup>th</sup> Feb 2020	156.6	+
9 <sup>th</sup> Jan 2020	135.45	+	27 <sup>th</sup> Feb 2020	156.35	-
10 <sup>th</sup> Jan 2020	138.05	+	28 <sup>th</sup> Feb 2020	153.6	-
13 <sup>th</sup> Jan 2020	143.3	+	2 <sup>nd</sup> Mar 2020	152.15	-
14 <sup>th</sup> Jan 2020	143.5	+	3 <sup>rd</sup> Mar 2020	153.85	+
15 <sup>th</sup> Jan 2020	143.1	-	4 <sup>th</sup> Mar 2020	153.75	-
16 <sup>th</sup> Jan 2020	143.85	+	5 <sup>th</sup> Mar 2020	154.5	+
17 <sup>th</sup> Jan 2020	141.45	-	6 <sup>th</sup> Mar 2020	149.0	-
20 <sup>th</sup> Jan 2020	143.25	+	9 <sup>th</sup> Mar 2020	143.95	-
21 <sup>st</sup> Jan 2020	146.1	+	11 <sup>th</sup> Mar 2020	144.95	+
22 <sup>nd</sup> Jan 2020	151.4	+	12 <sup>th</sup> Mar 2020	134.35	-
23 <sup>rd</sup> Jan 2020	154.15	+	13 <sup>th</sup> Mar 2020	138.05	+
24 <sup>th</sup> Jan 2020	153.85	-	16 <sup>th</sup> Mar 2020	130.85	-
27 <sup>th</sup> Jan 2020	155.7	+	17 <sup>th</sup> Mar 2020	131.25	+
28 <sup>th</sup> Jan 2020	155.3	-	18 <sup>th</sup> Mar 2020	121.4	-
29 <sup>th</sup> Jan 2020	156.15	+	19 <sup>th</sup> Mar 2020	120.4	-
30 <sup>th</sup> Jan 2020	155.95	-	20 <sup>th</sup> Mar 2020	131.75	+
1 <sup>st</sup> Feb 2020	151.65	-	23 <sup>rd</sup> Mar 2020	121.25	-
3 <sup>rd</sup> Feb 2020	152.8	+	24 <sup>th</sup> Mar 2020	128.75	+
4 <sup>th</sup> Feb 2020	154.75	+	25 <sup>th</sup> Mar 2020	131.75	+
5 <sup>th</sup> Feb 2020	156.65	+	26 <sup>th</sup> Mar 2020	129.75	-
6 <sup>th</sup> Feb 2020	155.65	-	27 <sup>th</sup> Mar 2020	128.9	-
7 <sup>th</sup> Feb 2020	163.65	+	30 <sup>th</sup> Mar 2020	126.9	-
10 <sup>th</sup> Feb 2020	164.45	+	31 <sup>st</sup> Mar 2020	126.05	-
11 <sup>th</sup> Feb 2020	160.1	-			
12 <sup>th</sup> Feb 2020	154.95	-			
13 <sup>th</sup> Feb 2020	157.55	+			
14 <sup>th</sup> Feb 2020	156.05	-			
17 <sup>th</sup> Feb 2020	150.5	-			





### CALCULATION ON FORTIS HEALTH

Applied runs( $r$ ) = 36

Number of positive runs ( $n_1$ ) = 32

Number of negative runs ( $n_2$ ) = 30

Absolute mean ( $\mu$ ) = 31.96

Standard deviation ( $\sigma$ ) = 3.89

Upper limit= 39.64

Lower limit= 24.34

The applied no of runs 36, where upper limit is 39.64 and lower limit is 24.34.

### INTERPRETATION

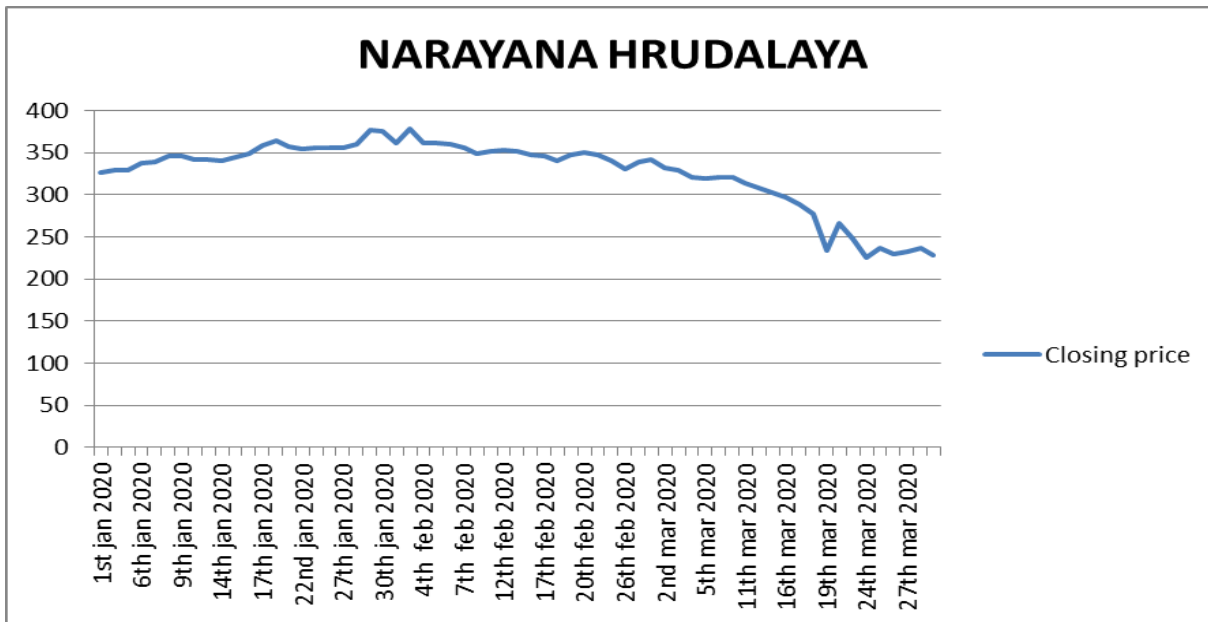
From the above table and graph, the study infers that in the month of January more number of positive changes in closing price, in the month February positive and negative changes both are equal and in the month of March more number of negative changes in closing price as the quantity of runs observed falls inside the upper and lower limits, it can be reasoned that prices are independent at a 5 % level of significance, null hypothesis,  $H_0$  is accepted. Therefore, the market is weakly efficient.



**C. DATA ANALYSIS ON THE CLOSING PRICE OF NARAYANA HRUDAYALAYA FOR THREE MONTHS**

Date	Closing price	Price change	Date	Closing price	Price change
1 <sup>st</sup> Jan 2020	326.0		18 <sup>th</sup> Feb 2020	341.00	-
2 <sup>nd</sup> Jan 2020	329.95	+	19 <sup>th</sup> Feb 2020	347.85	+
3 <sup>rd</sup> Jan 2020	329.30	-	20 <sup>th</sup> Feb 2020	350.65	+
6 <sup>th</sup> Jan 2020	337.75	+	24 <sup>th</sup> Feb 2020	347.15	-
7 <sup>th</sup> Jan 2020	339.30	+	25 <sup>th</sup> Feb 2020	340.20	-
8 <sup>th</sup> Jan 2020	346.15	+	26 <sup>th</sup> Feb 2020	330.80	-
9 <sup>th</sup> Jan 2020	345.85	-	27 <sup>th</sup> Feb 2020	338.70	+
10 <sup>th</sup> Jan 2020	342.65	-	28 <sup>th</sup> Feb 2020	342.45	+
13 <sup>th</sup> Jan 2020	341.70	-	2 <sup>nd</sup> Mar 2020	332.15	-
14 <sup>th</sup> Jan 2020	340.90	-	3 <sup>rd</sup> Mar 2020	329.65	-
15 <sup>th</sup> Jan 2020	344.15	+	4 <sup>th</sup> Mar 2020	320.40	-
16 <sup>th</sup> Jan 2020	349.15	+	5 <sup>th</sup> Mar 2020	320.00	-
17 <sup>th</sup> Jan 2020	358.65	+	6 <sup>th</sup> Mar 2020	321.45	+
20 <sup>th</sup> Jan 2020	363.90	+	9 <sup>th</sup> Mar 2020	320.40	-
21 <sup>st</sup> Jan 2020	357.45	-	11 <sup>th</sup> Mar 2020	314.45	-
22 <sup>nd</sup> Jan 2020	355.20	-	12 <sup>th</sup> Mar 2020	307.75	-
23 <sup>rd</sup> Jan 2020	355.95	+	13 <sup>th</sup> Mar 2020	302.95	-
24 <sup>th</sup> Jan 2020	356.70	+	16 <sup>th</sup> Mar 2020	296.75	-
27 <sup>th</sup> Jan 2020	355.85	-	17 <sup>th</sup> Mar 2020	289.35	-
28 <sup>th</sup> Jan 2020	360.20	+	18 <sup>th</sup> Mar 2020	277.10	-
29 <sup>th</sup> Jan 2020	377.25	+	19 <sup>th</sup> Mar 2020	233.50	-
30 <sup>th</sup> Jan 2020	375.65	-	20 <sup>th</sup> Mar 2020	266.25	+
1 <sup>st</sup> Feb 2020	361.35	-	23 <sup>rd</sup> Mar 2020	247.55	-
3 <sup>rd</sup> Feb 2020	377.85	+	24 <sup>th</sup> Mar 2020	225.65	-
4 <sup>th</sup> Feb 2020	361.10	-	25 <sup>th</sup> Mar 2020	236.15	+
5 <sup>th</sup> Feb 2020	361.45	+	26 <sup>th</sup> Mar 2020	229.90	-
6 <sup>th</sup> Feb 2020	359.95	-	27 <sup>th</sup> Mar 2020	233.10	+
7 <sup>th</sup> Feb 2020	355.60	-	30 <sup>th</sup> Mar 2020	237.35	+
10 <sup>th</sup> Feb 2020	349.35	-	31 <sup>st</sup> Mar 2020	227.95	-
11 <sup>th</sup> Feb 2020	351.50	+			
12 <sup>th</sup> Feb 2020	353.20	+			
13 <sup>th</sup> Feb 2020	351.35	-			

14 <sup>th</sup> Feb 2020	347.80	-			
17 <sup>th</sup> Feb 2020	346.25	-			



#### CALCULATION ON NARAYANA HRUDAYALAYA

Applied runs( $r$ ) = 28

Number of positive runs ( $n_1$ ) = 24

Number of negative runs ( $n_2$ ) = 38

Absolute mean ( $\mu$ ) = 30.41

Standard deviation ( $\sigma$ ) = 3.70

Upper limit= 37.66

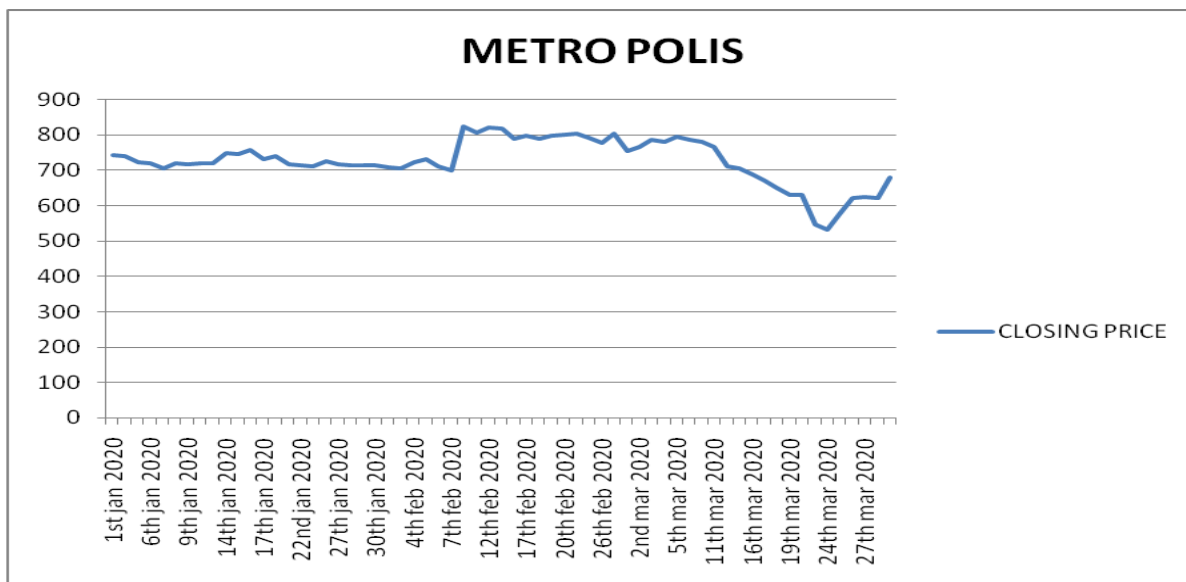
Lower limit= 23.15

Hence, the observed runs 28, whereas upper limit is 37.66 and lower limit is 23.15

**INTERPRETATION:** From the above table and graph, the study infers that in the month of January more number of positive changes in closing price, in the month of February more number of negative changes in closing price and in the month of March more number of negative changes in closing price. As the quantity of runs observed falls inside the upper and lower limits, it can be reasoned that prices are independent at a 5 % level of significance, null hypothesis,  $H_0$  is accepted. Thus, the market is weakly efficient.

**D. DATA ANALYSIS ON THE CLOSING PRICE OF METROPOLIS FOR THREE MONTHS**

Date	Closing	Price	Date	Closing	Price
1 <sup>st</sup> Jan 2020	1438.25		18 <sup>th</sup> Feb 2020	1826.8	+
2 <sup>nd</sup> Jan 2020	1406.0	-	19 <sup>th</sup> Feb 2020	1828.8	+
3 <sup>rd</sup> Jan 2020	1402.8	-	20 <sup>th</sup> Feb 2020	1827.0	-
6 <sup>th</sup> Jan 2020	1344.8	-	24 <sup>th</sup> Feb 2020	1777.65	-
7 <sup>th</sup> Jan 2020	1407.55	+	25 <sup>th</sup> Feb 2020	1818.25	+
8 <sup>th</sup> Jan 2020	1494.25	+	26 <sup>th</sup> Feb 2020	1856.3	+
9 <sup>th</sup> Jan 2020	1580.85	+	27 <sup>th</sup> Feb 2020	1837.75	-
10 <sup>th</sup> Jan 2020	1622.75	+	28 <sup>th</sup> Feb 2020	1861.65	+
13 <sup>th</sup> Jan 2020	1689.75	+	2 <sup>nd</sup> Mar 2020	1912.55	+
14 <sup>th</sup> Jan 2020	1691.85	+	3 <sup>rd</sup> Mar 2020	1990.7	-
15 <sup>th</sup> Jan 2020	1669.5	-	4 <sup>th</sup> Mar 2020	1876.0	-
16 <sup>th</sup> Jan 2020	1629.0	-	5 <sup>th</sup> Mar 2020	1809.05	-
17 <sup>th</sup> Jan 2020	1647.95	+	6 <sup>th</sup> Mar 2020	1764.25	-
20 <sup>th</sup> Jan 2020	1666.4	+	9 <sup>th</sup> Mar 2020	1700.45	-
21 <sup>st</sup> Jan 2020	1642.75	-	11 <sup>th</sup> Mar 2020	1737.4	+
22 <sup>nd</sup> Jan 2020	1642.05	-	12 <sup>th</sup> Mar 2020	1674.15	-
23 <sup>rd</sup> Jan 2020	1670.3	+	13 <sup>th</sup> Mar 2020	1691.1	+
24 <sup>th</sup> Jan 2020	1677.9	+	16 <sup>th</sup> Mar 2020	1587.15	-
27 <sup>th</sup> Jan 2020	1639.25	-	17 <sup>th</sup> Mar 2020	1647.0	+
28 <sup>th</sup> Jan 2020	1664.95	+	18 <sup>th</sup> Mar 2020	1553.2	-
29 <sup>th</sup> Jan 2020	1679.05	+	19 <sup>th</sup> Mar 2020	1538.75	-
30 <sup>th</sup> Jan 2020	1658.95	-	20 <sup>th</sup> Mar 2020	1550.2	+
1 <sup>st</sup> Feb 2020	1663.55	+	23 <sup>rd</sup> Mar 2020	1241.5	-
3 <sup>rd</sup> Feb 2020	1668.15	+	24 <sup>th</sup> Mar 2020	1138.65	-
4 <sup>th</sup> Feb 2020	1657.95	-	25 <sup>th</sup> Mar 2020	1320.25	+
5 <sup>th</sup> Feb 2020	1648.95	-	26 <sup>th</sup> Mar 2020	1391.45	+
6 <sup>th</sup> Feb 2020	1589.9	-	27 <sup>th</sup> Mar 2020	1373.75	-
7 <sup>th</sup> Feb 2020	1657.5	+	30 <sup>th</sup> Mar 2020	1267.65	-
10 <sup>th</sup> Feb 2020	1611.2	-	31 <sup>st</sup> Mar 2020	1286.25	+
11 <sup>th</sup> Feb 2020	1687.9	+			
12 <sup>th</sup> Feb 2020	1842.75	+			
13 <sup>th</sup> Feb 2020	1813.55	-			
14 <sup>th</sup> Feb 2020	1772.45	-			
17 <sup>th</sup> Feb 2020	1751.45	-			



### CALCULATION ON METRO POLIS

Applied runs( $r$ ) = 32

Number of positive runs ( $n_1$ ) = 30

Number of negative runs ( $n_2$ ) = 32

Absolute mean ( $\mu$ ) = 31.96

Standard deviation ( $\sigma$ ) = 3.89

Upper limit= 39.58

Lower limit= 24.33

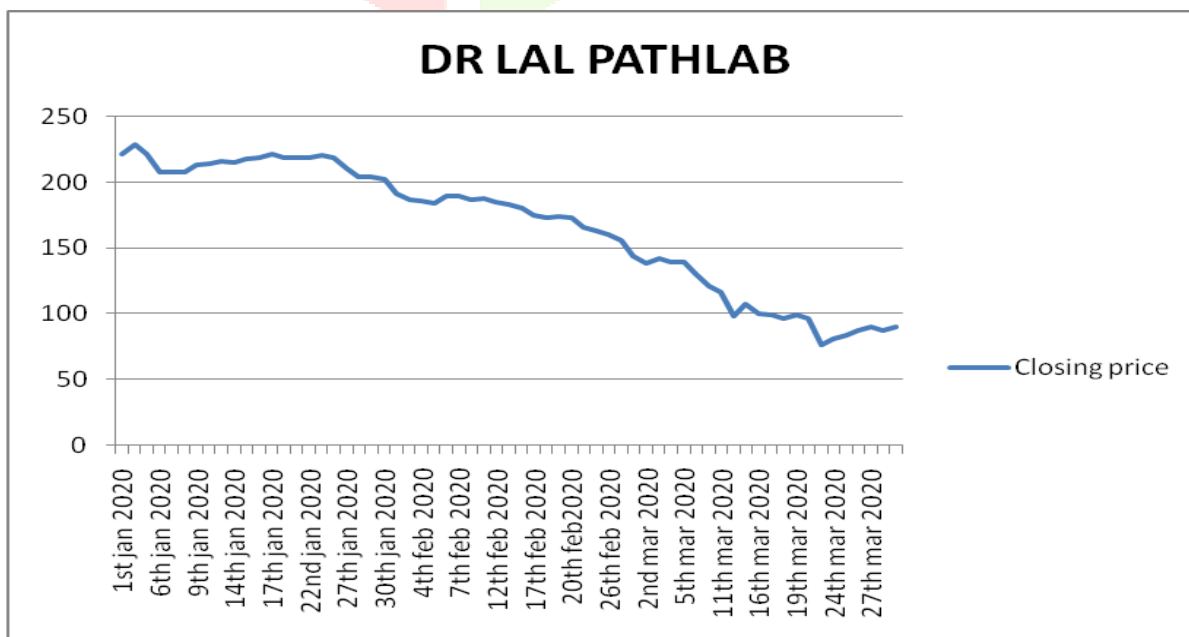
Hence, the applied no of runs 32, where upper limit is 39.58 and lower limit is 24.33.

**INTERPRETATION:** From the above table and graph, the study infers that in the month of January more number of positive changes in closing price, in the month February positive and negative changes both are equal and in the month of March more number of negative changes in closing price. As the quantity of runs observed falls inside the upper and lower limits, it can be reasoned that prices are independent at a 5 % level of significance, null hypothesis,  $H_0$  is accepted. Thus, the market is weakly efficient.

### E. DATA ANALYSIS ON THE CLOSING PRICE OF Dr. LAL PATHLAB FOR THREE MONTHS

Date	Closing Price	Price	Date	Closing Price	Price
1 <sup>st</sup> Jan 2020	1538.05		18 <sup>th</sup> Feb 2020	1629.95	-
2 <sup>nd</sup> Jan 2020	1534.15	-	19 <sup>th</sup> Feb 2020	1639.15	+
3 <sup>rd</sup> Jan 2020	1539.6	+	20 <sup>th</sup> Feb 2020	1617.65	-
6 <sup>th</sup> Jan 2020	1530.05	-	24 <sup>th</sup> Feb 2020	1637.35	+
7 <sup>th</sup> Jan 2020	1551.7	+	25 <sup>th</sup> Feb 2020	1650.8	+
8 <sup>th</sup> Jan 2020	1565.65	+	26 <sup>th</sup> Feb 2020	1646.3	-
9 <sup>th</sup> Jan 2020	1655.8	+	27 <sup>th</sup> Feb 2020	1640.05	-
10 <sup>th</sup> Jan 2020	1639.3	-	28 <sup>th</sup> Feb 2020	1627.55	-

13 <sup>th</sup> Jan 2020	1626.0	-	2 <sup>nd</sup> Mar 2020	1643.25	+
14 <sup>th</sup> Jan 2020	1601.6	-	3 <sup>rd</sup> Mar 2020	1676.15	+
15 <sup>th</sup> Jan 2020	1622.6	+	4 <sup>th</sup> Mar 2020	1716.15	+
16 <sup>th</sup> Jan 2020	1677.7	+	5 <sup>th</sup> Mar 2020	1704.2	-
17 <sup>th</sup> Jan 2020	1668.5	+	6 <sup>th</sup> Mar 2020	1633.7	-
20 <sup>th</sup> Jan 2020	1649.7	-	9 <sup>th</sup> Mar 2020	1634.45	-
21 <sup>st</sup> Jan 2020	1619.7	-	11 <sup>th</sup> Mar 2020	1628.5	-
22 <sup>nd</sup> Jan 2020	1595.75	-	12 <sup>th</sup> Mar 2020	1613.2	-
23 <sup>rd</sup> Jan 2020	1639.0	+	13 <sup>th</sup> Mar 2020	1571.25	-
24 <sup>th</sup> Jan 2020	1701.45	+	16 <sup>th</sup> Mar 2020	1455.35	-
27 <sup>th</sup> Jan 2020	1753.3	+	17 <sup>th</sup> Mar 2020	1502.3	+
28 <sup>th</sup> Jan 2020	1758.05	+	18 <sup>th</sup> Mar 2020	1467.65	-
29 <sup>th</sup> Jan 2020	1768.95	+	19 <sup>th</sup> Mar 2020	1352.2	-
30 <sup>th</sup> Jan 2020	1717.55	+	20 <sup>th</sup> Mar 2020	1408.8	+
1 <sup>st</sup> Feb 2020	1769.4	+	23 <sup>rd</sup> Mar 2020	1250.15	-
3 <sup>rd</sup> Feb 2020	1736.2	-	24 <sup>th</sup> Mar 2020	1341.1	+
4 <sup>th</sup> Feb 2020	1705.45	-	25 <sup>th</sup> Mar 2020	1402.05	+
5 <sup>th</sup> Feb 2020	1691.9	-	26 <sup>th</sup> Mar 2020	1419.65	+
6 <sup>th</sup> Feb 2020	1612.85	-	27 <sup>th</sup> Mar 2020	1499.55	+
7 <sup>th</sup> Feb 2020	1617.4	+	30 <sup>th</sup> Mar 2020	1422.15	-
10 <sup>th</sup> Feb 2020	1615.1	-	31 <sup>st</sup> Mar 2020	1401.4	-
11 <sup>th</sup> Feb 2020	1639.25	+			
12 <sup>th</sup> Feb 2020	1645.25	+			
13 <sup>th</sup> Feb 2020	1630.4	-			
14 <sup>th</sup> Feb 2020	1647.3	+			
17 <sup>th</sup> Feb 2020	1661.0	+			



**CALCULATION ON Dr. LAL PATHLAB**

Observed runs (r) = 28

Number of positive runs (n1) = 32

Number of negative runs (n2) = 30

Absolute mean ( $\mu$ ) = 31.96Standard deviation ( $\sigma$ ) = 3.89

Upper limit= 39.58

Lower limit= 24.33

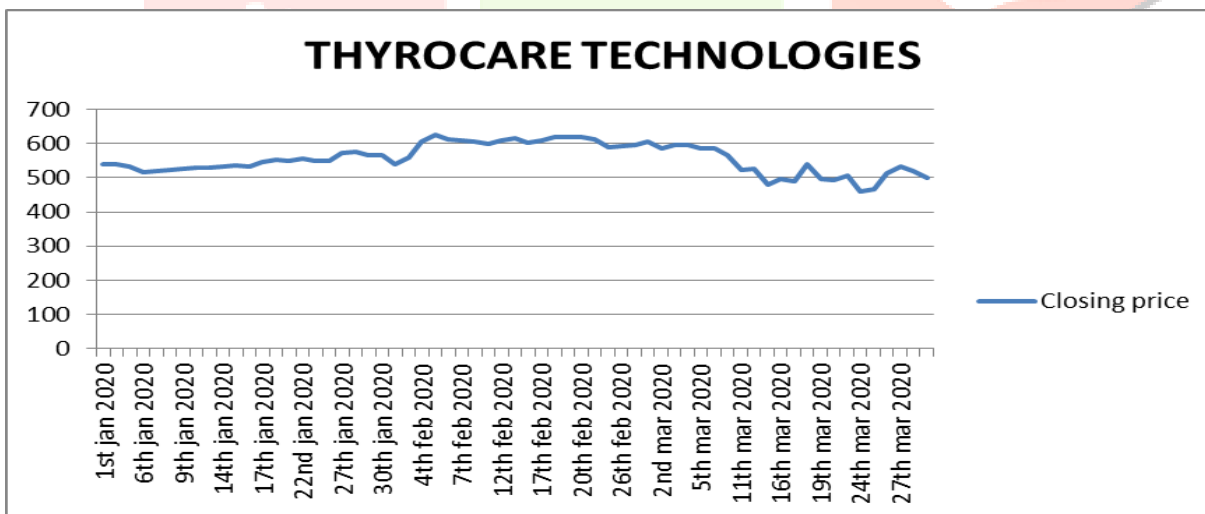
Therefore, the applied number of runs 28, where upper limit is 39.58 and lower limit is 24.33

**INTERPRETATION:** From the above table and graph, the study infers that in the month of January more number of positive changes in closing price, in the month February there are more number of negative changes in closing stock and in the month of March more number of negative changes in closing price. As the quantity of runs observed falls inside the upper and lower limits, it can be reasoned that prices are independent at a 5 % level of significance, null hypothesis,  $H_0$  is accepted. Hence, the market is weakly efficient.

**F. DATA ANALYSIS ON THE CLOSING PRICE OF THYROCARE TECHNOLOGIES**

Date	Closing price	Price change	Date	Closing price	Price change
1 <sup>st</sup> Jan 2020	538.40		18 <sup>th</sup> Feb 2020	619.90	+
2 <sup>nd</sup> Jan 2020	538.75	+	19 <sup>th</sup> Feb 2020	618.20	-
3 <sup>rd</sup> Jan 2020	533.30	-	20 <sup>th</sup> Feb 2020	618.70	+
6 <sup>th</sup> Jan 2020	517.95	-	24 <sup>th</sup> Feb 2020	611.80	-
7 <sup>th</sup> Jan 2020	520.05	+	25 <sup>th</sup> Feb 2020	590.45	-
8 <sup>th</sup> Jan 2020	521.75	+	26 <sup>th</sup> Feb 2020	591.20	+
9 <sup>th</sup> Jan 2020	527.70	+	27 <sup>th</sup> Feb 2020	596.90	+
10 <sup>th</sup> Jan 2020	529.10	+	28 <sup>th</sup> Feb 2020	605.65	+
13 <sup>th</sup> Jan 2020	529.40	+	2 <sup>nd</sup> Mar 2020	586.45	-
14 <sup>th</sup> Jan 2020	533.60	+	3 <sup>rd</sup> Mar 2020	596.05	+
15 <sup>th</sup> Jan 2020	537.50	+	4 <sup>th</sup> Mar 2020	596.15	+
16 <sup>th</sup> Jan 2020	534.35	-	5 <sup>th</sup> Mar 2020	587.40	-
17 <sup>th</sup> Jan 2020	547.55	+	6 <sup>th</sup> Mar 2020	586.50	-
20 <sup>th</sup> Jan 2020	551.55	+	9 <sup>th</sup> Mar 2020	565.20	-
21 <sup>st</sup> Jan 2020	550.05	-	11 <sup>th</sup> Mar 2020	522.85	-
22 <sup>nd</sup> Jan 2020	555.40	+	12 <sup>th</sup> Mar 2020	526.05	+
23 <sup>rd</sup> Jan 2020	550.50	-	13 <sup>th</sup> Mar 2020	479.05	-

24 <sup>th</sup> Jan 2020	549.10	-	16 <sup>th</sup> Mar 2020	497.00	+
27 <sup>th</sup> Jan 2020	571.70	+	17 <sup>th</sup> Mar 2020	491.10	-
28 <sup>th</sup> Jan 2020	575.50	+	18 <sup>th</sup> Mar 2020	538.95	+
29 <sup>th</sup> Jan 2020	566.80	-	19 <sup>th</sup> Mar 2020	497.60	-
30 <sup>th</sup> Jan 2020	565.05	-	20 <sup>th</sup> Mar 2020	491.90	-
1 <sup>st</sup> Feb 2020	539.85	-	23 <sup>rd</sup> Mar2020	505.75	+
3 <sup>rd</sup> Feb 2020	558.40	+	24 <sup>th</sup> Mar 2020	459.25	-
4 <sup>th</sup> Feb 2020	604.60	+	25 <sup>th</sup> Mar 2020	466.00	+
5 <sup>th</sup> Feb 2020	626.75	+	26 <sup>th</sup> Mar 2020	513.90	+
6 <sup>th</sup> Feb 2020	613.85	-	27 <sup>th</sup> Mar 2020	532.95	+
7 <sup>th</sup> Feb 2020	610.95	-	30 <sup>th</sup> Mar 2020	519.00	-
10 <sup>th</sup> Feb 2020	605.85	-	31 <sup>st</sup> Mar 2020	500.10	-
11 <sup>th</sup> Feb 2020	598.55	-			
12 <sup>th</sup> Feb 2020	609.40	+			
13 <sup>th</sup> Feb 2020	617.30	+			
14 <sup>th</sup> Feb 2020	602.95	-			
17 <sup>th</sup> Feb 2020	610.00	+			



### CALCULATION ON THYROCARE TECHNOLOGIES

Applied runs( $r$ ) = 32

Number of positive runs ( $n_1$ ) = 33

Number of negative runs ( $n_2$ ) = 29

Absolute mean ( $\mu$ ) = 31.87

Standard deviation ( $\sigma$ ) = 3.86

Upper limit= 39.22



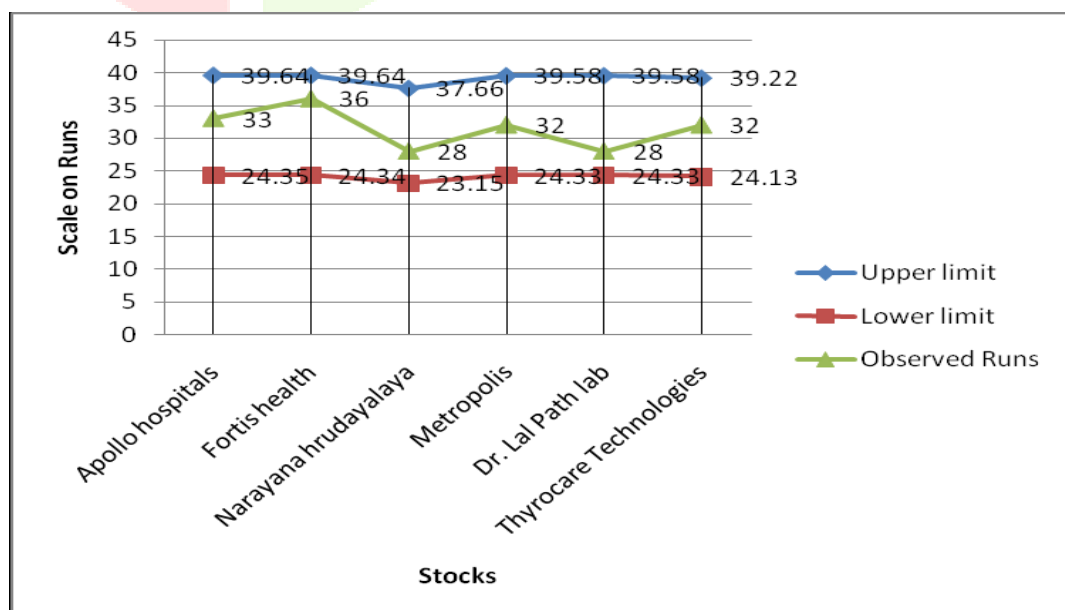
Lower limit= 24.13

The observed runs 33, where upper limit is 39.22 and lower limit is 24.13

**INTERPRETATION:** From the above table and graph, the study infers that in the month of January more number of positive changes in closing price, in the month of February also more number of positive changes in closing price and in the month of March more number of negative changes in closing price. As the quantity of runs observed falls inside the upper and lower limits, it can be reasoned that prices are independent at a 5 % level of significance, null hypothesis,  $H_0$  is accepted. Thus, the market is weakly efficient.

## HYPOTHESIS TESTING ON SELECTED SIX HEALTHCARE STOCKS

Stocks	n1	n2	$\mu$	$\sigma$	Upper limit	Lower limit	Observed Runs	Hypothesis tested at 5% level of significance
Apollo hospitals	31	31	32	3.90	39.64	24.35	33	$H_0$ is accepted
Fortis health	32	30	31.96	3.89	39.64	24.34	36	$H_0$ is accepted
Narayana hrudayalaya	24	38	30.41	3.70	37.66	23.15	28	$H_0$ is accepted
Metropolis	30	32	31.96	3.89	39.58	24.33	32	$H_0$ is accepted
Dr. Lal Path lab	31	30	31.96	3.89	39.58	24.33	28	$H_0$ is accepted
Thyrocare Technologies	33	29	31.87	3.86	39.22	24.13	32	$H_0$ is accepted



## INTERPRETATION

The above table and chart interprets the applied run tests of six stocks and showing the upper limit, lower limit and observed runs. All stocks observed runs falls between lower limit to upper limit. Therefore, null hypothesis is accepted and alternate hypothesis is rejected. Hence, the stocks observed runs, upper limit and lower limit are independent.

**CONCLUSION:** The present study has been concluding that the publicly available information enhances the ability of an investor to predict the future prices of stock at stock exchange. The selected healthcare stocks considered to test on efficiency based on closing prices retrieved at BSE for three months from January to March 2020. The Run test has been applied and found all the selected stocks are weakly efficient as per EMH. As a result, the study reveals that the market follows certain trend and violates random walk theory. Consequently, the information protects the interest of investors and helps to outperform the market by predicting and analyzing various trends.

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