TIME SERIES ANALYSIS
PRACTICAL – 7

Submitted By: Ridam Singhal(5040)

AIM: To Estimate trend using Grompertz curve by method of three selected points and comment on fitting of Grompertz curve in comparison with given data.

EXPERIMENT:

The following data gives the amount of savings and loan association in the US from 1945 to 1971:

YEAR	AMOUNT	YEAR	AMOUNT	YEAR	AMOUNT
1945	7.40	1954	27.3	1963	91.3
1946	8.50	1955	32.1	1964	101.9
1947	9.80	1956	37.1	1965	110.4
1948	11.00	1957	41.9	1966	114
1949	12.50	1958	48	1967	124.5
1950	14.00	1959	54.6	1968	131.6
1951	16.10	1960	62.1	1969	135.5
1952	19.20	1961	70.9	1970	146.4
1953	22.30	1962	80.2	1971	174.5

Estimate trend using Gompertz curve by method of three selected points.
Comment on fitting of Gompertz curve in comparison with given data.
Forecast amount for next five years.

THEORY:

METHOD OF THREE SELECTED POINTS:

Equation for modified exponential curve: $y_t = a + bc^t$
(1) Consider 3 ordinates, say y_1, y_2, y_3, corresponding to 3 equivalent values of t, say t_1, t_2, t_3, so that

$$t_2 - t_1 = t_3 - t_2$$

Now, substituting the values of $t = t_1, t_2, t_3$ in equation (1), we get:

- $y_1 = a + bc^{t1}$
- $y_2 = a + bc^{t2}$
- $y_3 = a + bc^{t3}$

Solving the above 3 equations, we get the values of a, b and c.

- $c = ((y_3 - y_2)/(y_2 - y_1))^{1/(t2-t1)}$
- $b = (((y_2 - y_1)^2)/(y_3 - 2y_2 + y_1)) * ((y_2 - y_1)/(y_3 - y_2))^{t1/(t2-t1)}$
- $a = (y_1 y_3 - y_2^2)/(y_3 - 2y_2 + y_1)$

GROMPERTZ CURVE:

The Grompertz curve describes a trend in which the growth increments of the logarithms are declining by a constant percentage. Thus the natural values of the trend would show a declining ratio of increase, but the ratio does not decrease by either a constant amount or a constant percentage.

Equation: $y_t = a + b^{c\wedge t}$
Taking log both sides,
$\log y_t = \log a + c^t * \log b$

Let, $\log y_t = Y_t$, $\log a = A$, $\log b = B$
Therefore, we get
$Y_t = A + Bc^t$

The above equation is comparable to the equation of modified exponential curve.

CALCULATIONS: (An excel sheet has also been attached)

Table 7.1

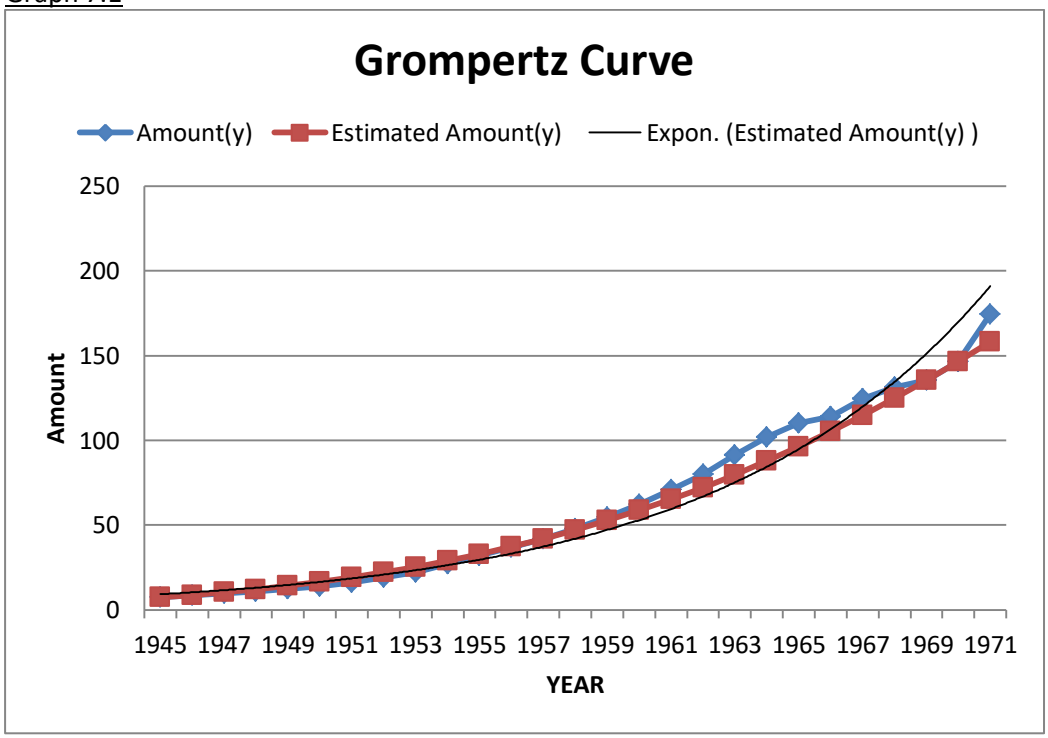
YEAR	Amount(y)	Yt	Yt(estimated)	Estimated Amount(y)
1945	7.4	2.00148	2.00148	7.4
1946	8.5	2.140066	2.173172385	8.786112806
1947	9.8	2.282382	2.339372115	10.37472039
1948	11	2.397895	2.500254909	12.18559978
1949	12.5	2.525729	2.655990861	14.23908803
1950	14	2.639057	2.806744625	16.55593462
1951	16.1	2.778819	2.952675588	19.15714183
1952	19.2	2.95491	3.093938037	22.06379515
1953	22.3	3.104587	3.230681323	25.29688646
1954	27.3	3.306887	3.363050022	28.87713257
1955	32.1	3.468856	3.491184079	32.82479187
1956	37.1	3.613617	3.615218969	37.1594818
1957	41.9	3.735286	3.735285827	41.9
1958	48	3.871201	3.851511596	47.06415148
1959	54.6	4.000034	3.964019158	52.66858448
1960	62.1	4.128746	4.072927462	58.72863705
1961	70.9	4.26127	4.178351654	65.2581964
1962	80.2	4.384524	4.280403193	72.26957275
1963	91.3	4.514151	4.379189977	79.77338894
1964	101.9	4.623992	4.474816448	87.77848699
1965	110.4	4.70411	4.567383708	96.29185234
1966	114	4.736198	4.656989626	105.3185563
1967	124.5	4.824306	4.743728939	114.8617165
1968	131.6	4.879767	4.827693353	124.922476
1969	135.5	4.908972	4.90897164	135.5
1970	146.4	4.986343	4.987649734	146.5914893
1971	174.5	5.161925	5.063810816	158.1922106
1972			5.137535411	170.2955422
1973			5.208901464	182.8930331
1974			5.277984427	195.9744761
1975			5.34485734	209.5279912
1976			5.409590905	223.5401198

A=	7.368334555
B=	-1.565E+28
c=	0.96800875

Table 7.2

Regression Statistics	
Multiple R	0.996359
R Square	0.992731
Adjusted R	0.99244
Standard E	4.400976
Observatic	27

Graph 7.1



RESULT:

- Trend values using Grompertz Curve (method of 3 selected points) have been calculated and shown in Table 7.1.
- The trend values have been plotted along with the given values in Graph 7.1.
- The amount for the next 5 years has been forecasted and shown in Table 7.1.

CONCLUSION:

- Estimated values are increasing exponentially.
- The R^2 value calculated in Table 7.2 is almost equal to 1 (0.992731). This indicates that the values estimated are almost equal to the given values.