-#-	M . A Ti O .
	Meaning of Time Series:
	Every process on earth is determine by a time
	Every process on earth is determine by a time variable. Time series refere to a sories in which
	and shaight is time. In time source the solve
	of variable are chronologically arranged ce consecutive reder.
	consecutive redor.
	for Example: If we observe production, sales,
	population, Crime state, district of time
	an poets exc. at affering point of since
	For Example: If we observe production, sales, population, crime rate, dollar rate, imports, exports etc. at different point of time say over last 5 or 10 years. The sot of observation formed shall constitute time series.
	V
	Hence, in the analysis of time series, time is most important jatter because the rariable is related to time which may be either year.
	most imboitant jattor because the sociable is
	related to time which may be either year.
	month, uxel, days, hours or even minutes.
2/	NOTE: Time Series Analysis is done for the purpose
	the purpose of evaluating past performance.
	The page of the page page of the page of t
x	Definition of Time Sovies:
1.	A set of data depending on time is called
	time solies.
2	A time sories is a set of statistical observations
	arrange in chronological order.
	The second of th

=====	
9	A time series consist of statistical data which are collected successive increment of time.
	Utility of Time Onics:
1	Analysis
	Poeccasting
	Evaluation
3.	Evallation
4.	Comparison.
	1
_ X _	Component of Time Series:
	There are 4 components of time sories:
.1	Secular Triend or Triend (T)
	Seasonal Variation (3)
3.	- your volume,
4.	Teagular Uniation (I)
	A A
1.	Secular Trand: Continuous movement in a trend of
	a particular type ice-upward trend
	as downward trend or gradual shift reflected
	in the time soxies over long poriod of time
	a particular type ire-upward trend or downward trend or gradual shift reflected in the time series over long period of time is called secular trend.
	IX COUNTY TO THE TOTAL OF THE T
	Eg. 1 > The population of India during the 50 years give an upward trend.
	give an upward trend.
	Eg. 2 > The child death rate over the last so years give an downward triend.
	give an downward triend.

- 12	
150	
2	Gensonal Trend/Variation (3):
13	
10-	Generally seasonal registion are occur due to
-	change in whether conditions, customers, traditions,
12	Lashion etc. Generally scaremal variation refusent in periodic movement where time period is
13	not longer than one year.
1.	
10	En 1 -> solo of mollen clothe go up in winter.
100	18 0 - Demand of electricity sizes solidly during
1	Eq. 1 -> Sale of wollen clothe go up in winter. Eq. 2 -> Demand of electricity rises roticity during summer every year.
2	
3.3.	Cyclic Variation (c): Different fluctuation moving up
Di-	El down every few year
3	throughout the length of time series use kisinges cucle
3	as cyclic haralton / frictialist to assert of
3	throughout the length of time series are known as cyclic shriatron / fluctuation or husiness cycle. Duration of cycle may be 4 to 5 years are even higher but always more than a year.
	even night. The transf
-3	Protectly
-	
-	
-	Noemal \
-9	
	Deparession
	Co. Penduction at costain item is stocked to new
	Eg : Production of Cexam ton is stores and items are
-3	itome are produced. Hyur suc
	adopted. Such changes form cycles.
- P	
<i>A</i>	

1	Inregular Voniation (I):
-4.	Tracqueur dibitation (12)
	The Man along one brown as ingrouphy
	Factors other than above are known as irregular reviation. They are sundern to are of non-securing. Es urbredictable in nature.
	Milation. They are standom to are of non- sectioning
	Es urbacdictable in native.
	Eg.: Unusual wether conditions, threat to international peace are example of irregular variation.
	peace are example of irregular variation.
	pare and cras pro
•	
_X	Measurement of Tound:
-	1 1 1
_1	Least Squaxo Method.
2,	Moving Average Method. Graphical Method.
3	Graphical Method.
1.	Least Square Method:
=	
	It is a mathematical method Ee with its help
	a transfer in the little of the state of the
	a trend line is fitted to the data in such a manner that the following two conditions are satisfied:
	a manner that the following two conditions are
-	satisfied:
_a.	≥(Y-Yc) = 0 (i.e. sum of actual value of Y Eo.
	z(Y-Yc) = 0 (i.e. sum of actual value of Y &c computed value of Y is equal to zero).
h.	$\leq (Y-Y_c)^2 = is least or minimum.$
-	JA SECOLO CO TIME (MI)
	(:
	(i.e. sum of square of deviation of actual Ee
	combited value is least from this line so hence the name least square method). The line is
	the name least square method. The line is
-1	obtain by this method is the line of best lit.
	J Description

-4)						
10						
Ja X	Eitting of a straig	ht Line Moth	ned the	nd:		
10-				C44		
-12-	The equation of	straight line	. Txon	d. is:		
2	Yc = a + b>c	-> (1)				
11.	where a & b =	constant.	to be	doloxs	nined	
1.	Normal as to					
1).	V	$\Sigma Y = Ma + bz$ $XY = a \leq X + b$	X	\rightarrow (2)		
2	5	$xy = a \leq x + b$	EX 2	→ (3)		
7,	.0					
2	where, n = no. of	years.	_			
2 2 2 2 2 2 2 2	I_{\perp} , $n = add$.					
·	1 = 800.	1		-		
2	time (+) Prod (y)	X=t-1993	ху	χ2		
8	2 1					
9	1991	-2		Х		
9	1992	-1			1	
9	(1993) = Middle Yr.	0		er e e		
•	1.994-	1				
•	1995	£X = 0			1	
•		= X = 0				
•	B. hilling reinin	to middle "	<i>2022</i>	110	ت ف. يواليد وا	
•	By shifting oxigin to middle years					
•	eg-n 2 Ee 3 can be weitten as					
,	V					
)	from eq - 2 > EY =	$= na \Rightarrow a =$	<u> </u>	= 7		
	·		e •		The North Control of the Control of	
	from eq 3 > EXY	1 = b≥x2 =>	b = 5	<u> </u>		
	U			-χ	The state of the s	

	T)	0140					
	T, m = 0	2001)					
	time (t)	Brook (X) x = t - 1993.	.5 X	/ Xº		
	1991		-2.5				6
	1992		- 1 - 5				
	11	>-Arcage	- 0.5				6
	1994	= 1993 5	0.5				
	1995	1000	1.5				5
	1996		2.5				67
			5X=0				Ð
							€
91-	The ear	of etanight	line trend	18			€
_		v				*	6
	% =	a+bx -	→(1)				1
1	ab	= constant	to be deter	mined,			1
	Normal	l eg- n are	the termination	·ww.			Ī
							7
	5.Y =	na + bex	\rightarrow (2)				7
			$\chi^2 \rightarrow (3)$				N.
							2
	n = 5 w	rich is odd				-	
	,,,,,,,,	W/ IS WW			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
	Year (t)	Parl-n(y)	X= t-1989	X2	W W		-
- (1	reuc (c)	Mac (1)	V i 1202		ХУ		1
				. ,			
	1.900	10	-4	4.0	70	1	100
	1.985	18	-4_	16	-72	1 2	
	1987	21	- 2	. 4-	-72 -42	-	1000
	1987	2 <u>1</u>	-2. O	4- 0			
	1987 1989 1991	21 23 27	-2. O	. 4-	-4-2		
	1987	21 23 27 16	-2 D 2 4-	4- 0	-4-2 0		
	1987 1989 1991	21 23 27	-2. O	0 4-	-4-2 0 54-		

4						
	from eq 2, 54 - na	+ PEX	(A) 11 (A)			
	EY = na					
63	105 = 50					
£	105 = 0					
	5					
	$\alpha = 21$.	·				
4	from eq ? 3, ZXY = a Z	v + h = Y 2				
_	from eq 3, = 2xy = 0 = 1	V T D Z-V				
	5/1 = D = V					
	4 = 40 4 = b					
	4-0		ļ			
	b = 0.1		100			
			E10240E			
	Put value of a Ee b is eg	n, we get straight line	1000			
	Put value of a Ee b is eq 1, we get straight line trend.					
	$y_c = a + bx$					
	Yc = 8.1 + 0.1 x	\rightarrow (4).	the street			
	the	geae	ALE IN			
	To estimate production in	1995 6 1997.				
_			1			
	t = 1.995	t = 1.997	7			
-	$\chi = \pm -1989$	x = t - 1989				
	x = 1995 -1989	x = 1997 - 1989	40.0			
	X = 6	X = 8				
	D+ 4 0 in 00-7 1-	Put x = 8 in eq 7 4				
-	Put x = 6 in eg- 4	146 /1 - 8 0/ 9				
	$Y_{c} = 21 + 0.1 \times 6$	Yc = 21 + 0.1 x 8	1			
-		$y_{c} = 91.8$				
	Yc = 21.6	\ <u></u>	1			

De 91 The eq n of shaight line bond is \[\begin{align*} \text{Vc} = 0 + b\times \\ \text{a.b. me constant to be determined} \\ \text{Notmal cq n me} \\ \text{sxy} = 0 \text{sx} + b \text{sx} \\ \text{sy} = 0 \text{sy} = 0 \text{sx} + b \text{sx} \\ \text{sy} = 0 \text{sy} + b \text{sy} = 0 \\ \text{sy} = 0 \text{sy} + b \text{sy} = 0 \\ \text{sy} = 0 \text{sy} + b \text{sy} = 0 \\ \text{sy} = 0 \text{sy} + b \text{sy} = 0 \\ \text{sy} = 0 \text{sy} + b \text{sy} = 0 \\ \text{sy} = 0 \text{sy} + b \text{sy} = 0 \\ \text{sy} = 0 \text{sy} + b \text{sy} = 0 \\ \text{sy} = 0 \text{sy} + b \text{sy} = 0 \\ \text{sy} = 0 \text{sy} + b \text{sy} = 0 \\ \text{sy} = 0 \text{sy} + b \text{sy} = 0 \\ \text{sy} = 0 \t						A.	6-			
Ye = $a + bx$ (1) a. b are constant to be determined Notemal eq. are $xy - ma + bxx$ (2) $xxy = axx + bxx^2$ (2) $xy = axx + bxx^2$ (2)	2.20l	Ine	The eg of straight line trand is							
0. b are constant to be designated Normal eq. new $SY = na + b \le X$ $SXY = a \le X + b \le X^2 \rightarrow (2)$ $197 = 10$. which is even. Year (1) Read (1) $X = t - 1981 \cdot 5$ $197 = 10 \cdot t \cdot t \cdot t \cdot t \cdot t$ $1977 = 75 = -4 \cdot 5 = 20 \cdot 25 = -337 \cdot 5$ $1978 = 86 = -3 \cdot 5 = 12 \cdot 25 = -301$ $1979 = 98 = -2 \cdot 5 = 6 \cdot 2.5 = -24.5$ $1979 = 98 = -2 \cdot 5 = 6 \cdot 2.5 = -24.5$ $1980 = 90 = -1 \cdot 5 = 2 \cdot 2.5 = -13.5$ $1981 = 96 = -0 \cdot 5 = 2.5 = -13.5$ $1982 = 108 = 0 \cdot 5 = 2.5 = -13.5$ $1982 = 108 = 0 \cdot 5 = 2.5 = -13.5$ $1982 = 108 = 0 \cdot 5 = 2.5 = -13.5$ $1984 = 140 = 2.5 = 6.2.5 = 3.50$ $1985 = 150 = 3.5 = 12.2.5 = 52.5$ $1986 = 165 = 4.5 = 20.2.5 = 742.5$ $1,132 = 0 = 82.5 = 79.1$ $1,132 = 100 = 7.3 = 82.5 = 79.1$ $1,132 = 100 = 7.3 = 82.5 = 79.1$ $1,132 = 100 = 7.3 = 82.5 = 79.1$ $1,132 = 100 = 7.3 = 82.5 = 79.1$ $1.132 = 100 = 7.3 = 82.5$ $1.132 = 100 = 7.3 = 82.5$ $1.132 = 100 = 7.3 = 82.5$ $1.132 = 100 = 7.3 = 82.5$ $1.132 = 100 = 7.3 = 82.5$ $1.132 = 100 = 7.3 = 82.5$ $1.132 = 100 = 7.3 = 82.5$ $1.132 = 100 = 7.3 = 82.5$ $1.132 = 100 = 7.3 = 82.5$ $1.132 = 100 = 7.3 = 82.5$ $1.132 = 100 = 7.3 = 82.5$ $1.132 = 100 = 7.3 = 82.5$ $1.132 = 100 = 7.3 = 82.5$ $1.132 = 100 = 7.3 = 82.5$ $1.132 = 100 = 7.3$ $1.132 = 100 = 7.3$ $1.132 = 100 = 7.3$ $1.132 = 1.32$ $1.132 = 1.32$ $1.132 = 1.32$ $1.132 = 1.32$ 1.132		11	V							
Notified eq and $\pm y - ma + b \pm x \rightarrow (x)$ $\pm xy - ma + b \pm x \rightarrow (x)$ $= xy - xy $		Yc	$\gamma_c = \alpha + bx - \gamma(1)$							
Notified eq and $\pm y - ma + b \pm x \rightarrow (x)$ $\pm xy - ma + b \pm x \rightarrow (x)$ $= xy - xy $		a. b are constant to be do to military								
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		Noemal eq" are								
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$										
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	***************************************		sy = matbex							
Yeax (t) $Rxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx$		2	XYE WEN	1)2/						
Yeax (t) $Rxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx$		D = 40	which is	even.						
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		1			r					
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		Year (t)	Pacod (y)	X= +-1981.5	_X2	XY				
1978 86 -3.5 12.25 -301 1979 98 -9.5 6.25 -245 1980 90 -1.5 9.25 -135 1921 96 -0.5 .25 -48 1982 108 0.5 .25 54 1983 124 1.5 2.25 186 1934 140 2.5 6.25 350 1935 150 3.5 12.25 525 1936 165 4.5 90.25 742.5 1,132 0 82.5 791 $tom eq^{-7} 2 \rightarrow \xi \gamma = \eta a + b \xi \chi$ $tom eq^{-7} 3 \rightarrow \xi \chi \gamma = a \xi \chi + b \xi \chi^2 = a \xi \chi + $										
1979 98 -2.5 6.25 -245 1980 90 -1.5 9.25 -135 1981 .96 -0.5 .95 -48 1982 108 0.5 .25 54 1983 124 1.5 2.25 186 1984 140 2.5 6.25 350 1985 150 3.5 12.25 525 1986 165 4.5 20.25 742.5 1,132 0 82.5 791 $tom eq^{-7} 2 \rightarrow EY = \eta a + b EX$ $tom eq^{-7} 2 \rightarrow EY = \eta a + b EX$ $tom eq^{-7} 2 \rightarrow EY = \eta a + b EX$ $tom eq^{-7} 3 \rightarrow EXY = 0 EX + b EX$ $tom eq^{-7} 2 \rightarrow EY = 0 EX + b EX$ $tom eq^{-7} 2 \rightarrow EX = 0 EX + b EX$ $tom eq^{-7} 2 \rightarrow EX = 0 EX + b EX$ $tom eq^{-7} 2 \rightarrow EX = 0 EX + b EX$ $tom eq^{-7} 2 \rightarrow EX = 0 EX + b EX$ $tom eq^{-7} 2 \rightarrow EX = 0 EX + b EX$ $tom eq^{-7} 2 \rightarrow EX = 0 EX + b EX$ $tom eq^{-7} 2 \rightarrow EX = 0 EX + b EX$ $tom eq^{-7} 2 \rightarrow EX = 0 EX + b EX$ $tom eq^{-7} 2 \rightarrow EX = 0 EX + b EX$ $tom eq^{-7} 2 \rightarrow EX = 0 EX + b EX$ $tom eq^{-7} 2 \rightarrow EX = 0 EX + b EX$ $tom eq^{-7} 3 \rightarrow EXY = 0 EX + b EX$ $tom eq$		1977	75	-4.5	20.25	-337.5				
1980 90 -1.5 9.25 -135 1921 96 -0.5 .25 -48 1982 108 0.5 .25 54 1983 124 1.5 2.25 186 1924 140 2.5 6.25 3.50 1935 150 3.5 12.25 525 1936 165 4.5 20.25 742.5 1,132 0 82.5 791 $1 \times 100 \times 10^{-7} 2 \rightarrow 2 \times 10^{-7} \times 10^{-7$		197.8	- 86	-3.5	12.25	-301				
1921 .96 -0.5		1979	98	- 9 · 5	6.25	-245				
1982 108 0.5 .25 54 1983 194 1.5 2.25 186 1984 140 2.5 6.25 3.50 1985 150 3.5 19.25 525 1986 165 4.5 90.25 742.5 1,132 0 82.5 791 $tom eq^{-7} 2 \rightarrow \xi Y = \eta a + b \xi X$ 1,132 = 100 1,132 = 0 $tom eq^{-7} 2 \rightarrow \xi Y = \eta a + b \xi X$ $tom eq^{-7} 2 \rightarrow \xi Y = \eta a + b \xi X$ $tom eq^{-7} 2 \rightarrow \xi Y = \eta a + b \xi X$ $tom eq^{-7} 2 \rightarrow \xi X = 0 \xi X + b \xi X^2 \xi X^2 = 0 \xi X + b \xi X^2 + b \xi X^2 = 0 \xi X $		1980	90	-1.5	2.25	-135				
1983 194 1.5 2.25 186 1984 140 2.5 6.25 3.50 1985 150 3.5 19.25 525 1986 165 4.5 90.25 742.5 1,132 0 82.5 791 from eq 7 2 \rightarrow \leq Y = 70 a + b \leq X c and eq 7 3 \rightarrow \leq XY = 0 \leq X + b \leq X c and eq a		1981	.96	-0.5	• 25	- 48				
1983 194 140 2.5 6.25 3.50 1985 150 3.5 19.25 525 1986 165 4.5 90.25 742.5 1,132 0 82.5 791 From eq 7 2 \rightarrow \leq Y = η a + b \leq X		1982	108	0.5	.25	.54				
1985 150 3.5 12.25 52.5 1986 165 4.5 20.25 742.5 1,132 0 82.5 791 from eq ⁻⁷ 2. \rightarrow \leq Y = η a + b \leq X \rightarrow \leq XY = α \leq X + b \leq XY = α α \leq XY = α α \leq XY = α α α \leq XY = α		1983	124	1.5	2.25	186				
1986 165 4.5 20.25 742.5 1,132 0 82.5 791 from $eq^{-7} 2 \rightarrow \xi Y = \eta a + b \xi X$ 1,132 = 100 1,132 = 0 791 = 89.5b 1,132 - 0 10 82.5 0 = 113.2 1 = 9.58	- T	1984-	140	2.5	6.25	350				
1,132 0 82.5 7.91 from eq 7 2 \rightarrow £Y = $\eta a + b \pm X$ from eq 7 3 \rightarrow £XY = $a \pm X + b \pm X^2 = 0$ 1,132 = 100 7.91 = $g \cdot 5 \cdot b$ 1,132 = $a \cdot g \cdot b$ 10 82.5 $a = 113.2$ $b = 9.58$		1985	150	3.5	12.25	525	0			
		1986	165	4.5	20.25	742.5	0			
$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	-		1,132	0	82.5	791				
$ \begin{array}{ccccccccccccccccccccccccccccccccccc$	-						意識を			
$ \begin{array}{ccccccccccccccccccccccccccccccccccc$		from eg-	2 -> EY =	na+bex	from egin	$g \to \xi XY = 0$	EX + hexe			
$ \begin{array}{ccccccccccccccccccccccccccccccccccc$		U U			D V					
$ \begin{array}{ccccccccccccccccccccccccccccccccccc$		1,132	=10a		7-91	= 80.5h				
$\begin{array}{c} 10 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 $		1,138	<u> </u>							
a = 113.2 $b = 9.58$			_							
3 30.		Q =	113.2							
					<u> </u>	9.20				
	400			2						

 Put value of a & b in eq. 1, we get straight line					
tound.		· · · · · · · · · · · · · · · · · · ·			
	Yc = a + bx	(.)			
	$\gamma_{c} = 0.10$	$58 \times \rightarrow (9)$			
 To estin	rate production.	in , 1987.			
 -		Pul x = 5.5 in eq 7 4.			
	1987	- Fill / - 5 5 50 50			
11 /	1981.5	Yc = 113.2 +9.58 € x 5.5			
	37 -1981.5	$\gamma_c = 16.5.89$			
$\chi = 5$	5	16. 16.9.9.			
 TI A As	on tound and				
labulatio	m of trend va				
Year (+)	X= +-1981.5	Yc = 113.2 + 9.58x			
1800 CL)	A - C 1./02.3				
1.977	-4.5	Yc = 113.2+9.58(-4.5) = 70.09			
1978	-3.5	$Y_{c} = 113.2 + 9.58(-3.5) = 79.67$			
1979	-2.5	$\gamma_c = 113.2 + 9.58(-2.5) = 89.2.5$			
1980	-1.5	$\gamma_c = 113.2 + 9.58(-1.5) = 98.83$			
1981	- 0.5	$\gamma_{c} = 113.2 + 9.58(-0.5) = 108.41$			
1982	0.5	$\gamma_c = 113.2 + 9.58 (0.5) = 117.99$			
1.983	1.5	$\frac{1}{2} = 113.2 + 9.58 (1.5) = 197.57$			
1984	2.5	$\gamma_c = 113 \cdot 2 + 9 \cdot 58 (9.5) = 137 \cdot 15$			
1985	3.5	$\frac{1}{2}$ \(\) \(
1986	4.5	$y_{c} = 113.2 + 9.58 (4.5) = 156.31$			
		, a septiment			
		an E-talling to			
	×				