Problem: The following table gives the population of a country for the year 2001, together with the estimated number of births and deaths. Calculate:

(i) CBR for the total population, (ii) GFR, (iii) TFR, (iv) GRR, (v) NRR.

Age (l.b.d)	Males		Females		Births		Survival Rates
	Population	Deaths	Population	Deaths	Males	Females	
0—4	442532	18623	434980	17308			
5—9	419042	1809	416736	1709			
10—14	393543	984	384616	1638			
15—19	308269	1233	314056	1329	3578	3343	0·914
20—24	257852	1289	269340	1481	7293	6690	0·899
25—29	230629	1776	236187	1677	6775	6361	0·844
30—34	204188	1633	203477	1465	4233	4187	0·868
35—39	182270	1588	176534	1289	2999	2685	0·852
40—44	162509	1967	145037	1233	593	725	0·834
45—49	128784	2138	122946	1352	129	128	0·819
50—54	102971	1905	96589	1188			
55—59	80717	2478	78311	1605			
60—64	58899	3099	58142	1980			
65—69	37797	2428	39099	2468			
70 and above	45099	5981	48866	7175			

Theory: **(i)** CBR for the total population is given by,

$$CBR = \frac{\sum B}{\sum P} \times 1000 ,$$

Where, $\sum B$ = Total number of live births in the given period

$\sum P$ = Total population in that given period

(ii) GFR is given by,

$$\text{GFR} = \frac{\sum B_x}{\sum_{\lambda_1}^{\lambda_2} {}^{f}P_x} \times 1000 ,$$

Where, $\sum B_x$ = Number of live children born among the population in the given period

$\sum_{\lambda_1}^{\lambda_2} {}^{f}P_x$ = Female population in the reproductive age

λ_1, λ_2 = Lower and upper limits of the female child bearing age

(iii) TFR is given by,

$$TFR = \sum AgeSFR \times i$$
$$= \sum_{\lambda_1}^{\lambda_2} \left(\frac{{}_{n}B_x}{{}_{n}^{f}P_x} \times 1000 \right) \times i$$
$$= i \times \sum {}_{n}i_x$$

(iv) GRR is given by,

$$GRR = \frac{No.of\ \ female\, births}{Total\, no.of\ births} \times TFR$$

(v) NRR is given by,

$$NRR = k \sum_{x} n \left[\frac{{}_{n}^{f}B_x}{{}_{n}^{f}P_x} \times {}_{n}^{f}\pi_x \right],$$

Where, $k=1000$, n= age interval, ${}_{n}^{f}\pi_x$ = survival factor of female,

${}_{n}^{f}B_x$ = female birth, ${}_{n}^{f}P_x$ = female population

Calculation: First we prepare the following tables:

Table 1

	Males	Females	Total
Total population	3055101	3024916	6080017
Births	25600	24119	49719

Table 2 (Computation of GFR, TFR, GRR, NRR)

Age group (1)	${}_nP_x^f$ (2)	${}_nB_x^m$ (3)	${}_nB_x^f$ (4)	Total birth (3)+(4)= (5)	Age SFR ${}_ni_x = \frac{(5)}{(2)} \times 1000$ (6)	Female AgeSFR ${}_ni_x^f = \frac{(4)}{(2)} \times 1000$ (7)	${}_n\pi_x^f$ (8)	${}_ni_x^f \times {}_n\pi_x^f$ (7) ×(8)= (9)
15-19	314056	3578	3343	6921	22.037	10.645	0.914	9.7295
20-24	269340	7293	6690	13983	51.916	24.838	0.899	22.3294
25-29	236187	6775	6361	13136	55.617	26.932	0.844	22.7306
30-34	203477	4233	4187	8420	41.381	20.577	0.868	17.808
35-39	176534	2999	2685	5684	32.198	15.210	0.852	12.9589
40-44	145037	593	725	1318	9.087	4.999	0.834	4.1692
45-49	122946	129	128	257	2.090	1.041	0.819	0.8526
Total	1467577	25600	24119	49719	214.326	104.242		90.6310

Now,

$$CBR = \frac{\sum B}{\sum P} \times 1000$$
$$= \frac{49719}{6080017} \times 1000 = 8.17$$

$$GFR = \frac{\sum_{\lambda_2} B_x}{\sum_{\lambda_1} {}^fP_x} \times 1000$$
$$= \frac{49719}{1467577} \times 1000 = 33.879$$

$$TFR = i \times \sum {}_ni_x = 5 \times 214.326 = 1071.63$$

$$GRR = \frac{No.of\ \ female\, births}{Total\, no.of\ births} \times TFR$$
$$= \frac{24119}{49719} \times 1071.63 = 519.85$$

$$NRR = k\sum_x n\left[\frac{{}_nB_x^f}{{}_nP_x^f} \times {}_n\pi_x^f\right]$$
$$= 5 \times ({}_ni_x^f \times {}_n\pi_x^f) = 5 \times 90.63 = 453.16$$

Problem: Calculate: (i) GFR, (iii) TFR, (iv) GRR from the following data:

Age group of child bearing females	:	*15—19*	*20—24*	*25—29*	*30—34*	*35—39*	*40—44*	*45—49*
Number of women ('000)	:	*16·0*	*16·4*	*15·8*	*15·2*	*14·8*	*15·0*	*14·5*
Total Births	:	*260*	*2244*	*1894*	*1320*	*916*	*280*	*145*

Assume that the proportion of female births is 46·2 per cent.