

UNIVERSITY OF SWAZILAND

SUPPLEMENTARY EXAMINATION PAPER 2007

**TITLE OF PAPER: INDIRECT TECHNIQUES OF DEMOGRAPHIC
ESTIMATION**

COURSE CODE : DEM 303

TIME ALLOWED : THREE (3) HOURS

**INSTRUCTIONS : ANSWER ALL QUESTIONS FROM SECTION A
AND ANY THREE (3) QUESTIONS FROM
SECTION B.**

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SECTION A: ANSWER ALL QUESTIONS (40 MARKS)

QUESTION 1 (8+8+4 marks)

- a. What is meant by model life table? Describe any three uses of model life tables.
- b. Point out two (2) similarities and two (2) differences between the Coale-Demeny model life tables and the United Nations model life tables for developing countries.
- c. Specify the family of the life tables that would best represent the mortality pattern in the following populations:
 - i. A population with high malnutrition among infants and children.
 - ii. A population with high incidence of neonatal tetanus.
 - iii. A population with high mortality during infancy and childhood years and young adult years.
 - iv. A population with high male death rate at older ages in relation to their death rates at younger ages.

QUESTION 2 (4+16 marks)

- a. What are the assumptions of the P/F ratio method for estimating fertility based on children ever born?
- b. In the 1973 Sudanese census, data was obtained on children ever born and births in the last 12 months. Based on these results, attempt was made to estimate the total fertility rate (TFR) using the Trussel variant of Brass P/F ratio method (Manual X method). The results are shown in Tables 1 and 2 below using standard symbols.
 - i. Fill in the blanks in the tables
 - ii. Estimate the adjusted TFR for Sudan.

NB. Please refer to the attached Appendix for the relevant formulae and coefficients.

Table 1.

i	ASFR	o (i)	Parity	F(i)	P(i)/F(i)
1	0.1061	0.5304	0.369	0.234	-----
2	0.2496	1.7784	1.792	-----	1.43
3	0.2567	-----	3.283	2.5673	1.28
4	0.1986	4.0549	4.358	3.650	1.19
5	0.1425	4.7674	5.01	4.5173	1.11
6	0.0551	-----	4.943	-----	1.01
7	0.0312	5.1989	4.854	5.1622	0.94

Table 2

i	w(i)	1-w(i)	f+(i)	f*(i)
1	0.083	1.00	0.127	0.165
2	0.1045	0.9170	0.256	0.333
3	0.1168	0.8955	0.253	-----
4	0.1215	0.8832	0.193	0.251
5	0.1716	0.8785	-----	0.176
6	-----	0.8284	0.051	0.066
7		0.8224	0.026	0.034

SECTION B: ANSWER ANY THREE (3) QUESTIONS**(60 MARKS)****QUESTION 3 (15+5 marks)**

- a. Use the data shown in the table below to estimate the following parameters of a stable population:
- Intrinsic rate of growth;
 - Intrinsic birth rate; and
 - Intrinsic birth rate.

Table A: Age Specific Fertility Rates and rates of survival by age of women

Age of Women	ASFR	Lx/lo
15-19	0.021	0.881
20-24	0.197	0.897
25-29	0.201	0.856
30-34	0.150	0.839
35-39	0.105	0.821
40-44	0.041	0.800
45-49	0.004	0.776

- b. Give a short description of a stable population.

QUESTION 4 (4+4+8+4 marks)

- What is the probability of a female surviving to age 4 in a population whose probability of surviving to age 5 is 0.785? Assume that the North Model is applicable.
- Using the West Model, compute the percentage change in the under five female mortality when the level changes from 9 to 10.

- c. What are the assumptions of the Coale and Trussel marital fertility model? Explain the meanings of the parameters of the model.
- d. Give any four uses of the Brass Logit model.

QUESTION 5 (10+10 marks)

Describe in detail the following methods:

- a. Reverse survival technique;
- b. Preceding birth technique.

Note: Make sure to describe the assumptions, data requirements, computational procedure, resulting estimates, and limitations.

QUESTION 6 (4+12+4 marks)

- a. One method of estimating fertility is by using the increment of cohort parities between two surveys/censuses. Under what conditions is it appropriate to use this method?
- b. The data below show the average parities of women at two surveys 5 years apart $P(i, 1)$ and $P(i, 2)$. Using the data calculate the inter-survey age specific fertility rates $f(1, s)$, $f(2, s)$, and $f(3, s)$.

Age Group	i	$P(i,1)$	$P(i,2)$
15-19	1	0.131	0.127
20-24	2	0.994	0.884
25-29	3	2.409	2.126
30-34	4	3.819	3.481
35-39	5	5.082	4.660
40-44	6	5.921	5.677

You may find the following formula useful:

$$O(i,s) = 0.9283 P(i, s) + 0.4547 P(i+1, s) - 0.0585 P(i+2, s) - 0.3245 O(i-1, s);$$

where $P(i,s) = P(i-1,s) + P(i, 2) - P(i-1, 1)$

- c. What are the limitations of this method?

TABLE XIV. Values of l_x by single years of age from 1 to 5 for regional model life tables ($l_0 = 100,000$).

LEVEL	Females					Males				
	l_1	l_2	l_3	l_4	l_5	l_1	l_2	l_3	l_4	l_5
1	63445	54958	51154	48696	46836	58050	50262	46851	44617	42957
2	66601	58514	54891	52549	50776	61614	54105	50817	48663	47062
3	69444	61785	58353	56135	54456	64826	57643	54497	52437	50906
4	72027	64811	61578	59488	57907	67743	60918	57929	55972	54517
5	74389	67625	64593	62634	61152	70411	63965	61142	59293	57919
6	76562	70251	67423	65596	64213	72865	66812	64160	62424	61133
7	78571	72713	70088	68391	67107	75135	69481	67004	65382	64177
8	80438	75028	72604	71037	69852	77243	71992	69691	68185	67066
9	82178	77211	74986	73547	72459	79209	74360	72237	70846	69813
10	83807	79276	77246	75933	74940	81049	76601	74654	73378	72430
11	85336	81233	79394	78206	77307	82775	78726	76953	75791	74928
12	86775	83092	81441	80374	79567	84401	80745	79144	78096	77316
13	88121	84865	83405	82462	81749	85983	82816	81428	80520	79844
14	89396	86646	85413	84616	84013	87487	84756	83560	82719	82194
15	90606	88290	87242	86559	86037	88804	86446	85414	84738	84235
16	91769	89864	88987	88407	87954	90084	88086	87208	86632	86203
17	92884	91352	90635	90153	89772	91322	89716	88976	88477	88098
18	93949	92759	92192	91806	91496	92517	91266	90662	90244	89921
19	94965	94089	93664	93372	93134	93666	92736	92266	91933	91672
20	95931	95347	95059	94859	94693	94767	94129	93791	93547	93353
21	96884	96531	96355	96231	96127	95866	95460	95236	95070	94937
22	97718	97507	97400	97324	97260	96901	96648	96501	96391	96302
23	98470	98361	98305	98264	98230	97838	97699	97616	97552	97499
24	99095	99048	99024	99007	98992	98652	98588	98548	98517	98492
25	99555	99540	99533	99527	99522	99289	99266	99252	99240	99231

LEVEL	Females					Males				
	l_1	l_2	l_3	l_4	l_5	l_1	l_2	l_3	l_4	l_5
1	68005	59681	54557	50689	47753	62858	54755	49828	46166	43381
2	70776	62905	58061	54403	51626	66052	58313	53606	50109	47449
3	73263	65852	61290	57847	55232	68919	61570	57101	53780	51254
4	75516	68564	64285	61055	58602	71515	64572	60350	57212	54826
5	77570	71074	67074	64055	61763	73883	67354	63382	60432	58187
6	79456	73407	69683	66871	64737	76057	69943	66224	63461	61359
7	81196	75585	72130	69523	67543	78062	72362	68895	66319	64360
8	82808	77625	74434	72025	70197	79920	74631	71413	69023	67205
9	84308	79542	76608	74394	72712	81650	76764	73793	71586	69906
10	85709	81349	78665	76639	75101	83264	78777	76048	74019	72477
11	87022	83056	80615	78772	77373	84777	80679	78187	75927	74927
12	88253	84670	82464	80799	79535	86196	82479	80218	78335	77261
13	89398	86244	84302	82837	81724	87529	84247	82250	80767	79638
14	90441	87729	86046	84770	83796	88709	85835	84087	82789	81801
15	91453	89164	87717	86609	85751	89858	87367	85852	84726	83870
16	92431	90521	89291	88340	87595	90975	88909	87598	86608	85846
17	93372	91802	90773	89971	89335	92054	90336	89258	88339	87730
18	94274	93012	92170	91508	90978	93091	91759	90827	90099	89526
19	95136	94153	93487	92959	92531	94091	93061	92309	91712	91237
20	95956	95230	94729	94330	94003	95043	94286	93706	93240	92866
21	96736	96246	95904	95628	95401	95950	95437	95026	94691	94420
22	97487	97221	97032	96879	96753	96826	96534	96290	96089	95925
23	98122	97974	97867	97780	97708	97580	97408	97258	97134	97032
24	98723	98648	98593	98510	98510	98321	98230	98148	98079	98022
25	99219	99187	99163	99144	99127	98944	98904	98866	98834	98807

APPENDIX

TABLE OF COEFFICIENTS

$$F(i) = \phi(i-1) - a(i) f(i) + b(i) f(i+1) + c(i) \phi(7) \quad (1)$$

Where a(i), b(i) and c(i) have the following values:

Age group	i	a(i)	b(i)	c(i)
15-19	1	2.351	-0.188	0.0024
20-24	2	3.321	-0.754	0.0161
25-29	3	3.265	-0.627	0.0145
30-34	4	3.442	-0.563	0.0029
35-39	5	3.518	-0.763	-0.0006
40-44	6	3.862	-2.481	-0.0001
45-49	7	3.828	0.016 ^a	-0.0002

^a This coefficient should be applied to f(6) instead of f(8)

$$w(i) = x(i) + \frac{y(i) \bar{f}(i)}{\phi(7)} + \frac{z(i) \bar{f}(i+1)}{\phi(7)} \quad (2)$$

Where x(i), y(i) and z(i) have the following values:

Age group	i	x(i)	y(i)	z(i)
15-19	1	0.031	2.287	0.114
20-24	2	0.068	0.999	-0.233
25-29	3	0.094	1.219	-0.977
30-34	4	0.120	1.139	-1.531
35-39	5	0.162	1.739	-3.592
40-44	6	0.270	3.454	-21.497

$$\bar{f}(i) = (1 - w(i-1)) f(i) + w(i) f(i+1) \quad (3)$$