

UNIVERSITY OF ESWATINI
DEPARTMENT OF STATISTICS AND DEMOGRAPHY
MAIN EXAMINATION 2019

TITLE OF PAPER : INDIRECT TECHNIQUES OF DEMOGRAPHIC ESTIMATION II

COURSE CODE : DEM 314

TIME ALLOWED : TWO (2) HOURS

INSTRUCTIONS : ANSWER QUESTIONS 1, 2 AND EITHER 3 OR 4

SHOW ALL YOUR WORKINGS INCLUDING
FORMULAE WHERE APPLICABLE.

REQUIREMENTS : SCIENTIFIC CALCULATOR

THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR

Question 1

[20]

Consider the developing country A whose mortality experience is represented by the life table in Table 1.

Table 1: Mortality experience: Country A

Age x	Number surviving to age x out of 100,000 births
15	96457
20	95800
25	94912
30	94042
35	93044
40	91645
45	89537
50	86259

Using the data in Table 1, and the General Standard life table in APPENDIX:

- 1.1 Determine the parameters alpha (α) and beta (β) in a Brass logit model life table fitted to all ages or the data provided above. [10]
- 1.2 Interpret the values of the Brass parameters obtained in part b); [4]
- 1.3 Derive a fitted life table using the parameters derived in part b) and the General standard; and [4]
- 1.4 Compare the fitted life table values with the observed ones. [2]

Question 2

[20]

Using the population census data for Country C in year 2002 shown in Table 2, a demographer estimated male child mortality using the Brass Children Ever Born-Children Surviving technique as displayed in Tables 2. The demographer assumed mortality follows the North model life table which is provided in the Appendix. Coefficients for estimation of child mortality multipliers and for estimation of the reference period are also provided in the Appendix.

Table 2 Data observed for Country C required for Brass Children Ever Born: Children Surviving technique computations

Table 2

Age group	Index	Wi	CEBi	CSi	CDi	Pi	Di
15-19	1	766882	69352	64317	5035	0.0904	0.0726
20-24	2	658857	347375	319447	27928	0.5272	0.0804
25-29	3	513783	535319	489377	45942	1.0419	0.0858
30-34	4	360277	546691	500238	46453	1.5174	0.0850
35-39	5	268789	555112	507881	-----	-----	-----
40-44	6	239716	612986	552286	60700	2.5571	0.0990
45-49	7	191154	548148	482831	65317	2.8676	0.1192
Total		2999458	3214983	2916377	298606		

Table 2 (continued)

Age group	Index	Coefficients ^a			Ki	qx	lx
		ai	bi	ci			
15-19	1	1.1415	-2.7070	0.7663	1.0650	0.0773	0.9227
20-24	2	1.2563	-0.5381	-0.2637	1.0306	0.0829	0.9171
25-29	3	1.1851	0.0633	-0.4177	0.9846	0.0845	0.9155
30-34	4	1.1720	0.2341	-0.4272	0.9960	0.0846	0.9154
35-39	5	1.1865	0.3080	-0.4452	-----	-----	-----
40-44	6	1.1746	0.3314	-0.4537	1.0019	0.0992	0.9008
45-49	7	1.1639	0.3190	-0.4435	0.9942	0.1185	0.8815

^a Coefficients for estimation of child mortality multipliers, Trussell variant

Table 2 (continued)

Age group	Coefficients ^b			Age x	qx	tx	Mortality level	Reference date
	ai	Bi	ci					
15-19	1.0970	5.5628	-1.9956	1	q1	1.0413	17.75	2001.6
20-24	1.3062	5.5677	0.2960	2	q2	2.4110	18.26	2000.2
25-29	1.5305	2.5528	4.8962	3	q3	4.4460	18.51	1998.2
30-34	1.9991	-2.4261	10.4282	5	q5	-----	-----	-----
35-39	2.7632	-8.4065	16.1787	10	q10	9.5082	19.20	1993.1
40-44	4.3468	-13.2436	20.1990	15	q15	12.2965	18.82	1990.3
45-49	7.5242	-14.2013	20.0162	20	q20	15.2171	18.36	1987.4

Given the data provided Tables 2, appropriate Coale and Demeny Model Life Tables in the Appendix provided at the end of this paper.

- 2.1 Fill in the blank spaces in Table 2, and [18]
- 2.2 Comment on the levels of child mortality in this Country. [2]

Note: Copies of the relevant life tables are provided at the end of this paper.

ANSWER EITHER

Question 3 [20]

3.1 Explain the meaning of the following mortality models:

3.1.1 Empirical models and [2]

3.1.2 Relational models. [2]

3.2 Explain any two uses of mortality model life tables; [4]

3.3 Describe the characteristics of each region of the United Nations model life tables. [12]

OR

Question 4 [20]

Write in detail notes on the purpose, data required, assumptions and limitations of the **ANY ONE** of the following indirect estimation methods:

4.1 Orphanhood method, [20]

4.2 Brass growth balance method. [20]

APPENDIX

Table A1: Brass General and African Standard life table l_x 's values

Age x	General Standard l_x	Age x	African Standard l_x
0	1	0	1
1	0.8499	1	0.8802
2	0.807	2	0.8335
3	0.7876	3	0.8101
4	0.7762	4	0.7964
5	0.7691	5	0.7863
10	0.7502	10	0.7502
15	0.7362	15	0.7362
20	0.713	20	0.713
25	0.6826	25	0.6826
30	0.6525	30	0.6525
35	0.6223	35	0.6223
40	0.5898	40	0.5898
45	0.5535	45	0.5535
50	0.5106	50	0.5106
55	0.4585	55	0.4585
60	0.3965	60	0.3965
65	0.321	65	0.321
70	0.238	70	0.238
75	0.1516	75	0.1516
80	0.0768	80	0.0768
85	0.0276	85	0.0276
90	0.0059	90	0.0059
95	0.0006	95	0.0006
100	0	100	0

Source: Carrier and Hobcraft (1973)

Table A2: Coefficients of estimation of child mortality Multipliers, Trussell variant: North Model

Age group	ai	bi	ci
15-19	1.1119	-2.9287	0.8507
20-24	1.2390	-0.6865	-0.2745
25-29	1.1884	0.0421	-0.5156
30-34	1.2046	0.3037	-0.5656
35-39	1.2586	0.4236	-0.5898
40-44	1.2240	0.4222	-0.5456
45-49	1.1772	0.3486	-0.4624

Table A3: Coefficients for estimation of the reference period $t(x)$, North Model

Age group	ai	bi	ci
15-19	1.0921	5.4732	-1.9672
20-24	1.3207	5.3751	0.2133
25-29	1.5996	2.6268	4.3701
30-34	2.0779	-1.7908	9.4126
35-39	2.7705	-7.3403	14.9352
40-44	4.152	-12.2448	19.2349
45-49	6.965	-13.916	19.9542

TABLE 228. MALE PROBABILITY OF SURVIVING FROM BIRTH, $l(x)$, NORTH MODEL

Level	Probability of surviving from birth, $l(x)$									
	$l(1)$	$l(2)$	$l(3)$	$l(4)$	$l(5)$	$l(10)$	$l(15)$	$l(20)$	$l(25)$	$l(30)$
1.....	0.62883	0.54784	0.49858	0.46197	0.43413	0.37865	0.35414	0.33041	0.29946	0.26970
2.....	0.66077	0.58341	0.53637	0.50141	0.47482	0.41960	0.39484	0.37056	0.33867	0.30777
3.....	0.68944	0.61599	0.57133	0.53813	0.51289	0.45855	0.43384	0.40930	0.37688	0.34525
4.....	0.71541	0.64603	0.60383	0.57247	0.54862	0.49563	0.47123	0.44669	0.41407	0.38206
5.....	0.73911	0.67387	0.63419	0.60470	0.58227	0.53101	0.50711	0.48278	0.45025	0.41816
6.....	0.76087	0.69979	0.66265	0.63504	0.61405	0.56480	0.54158	0.51762	0.48544	0.45353
7.....	0.78096	0.72404	0.68942	0.66369	0.64412	0.59713	0.57473	0.55129	0.51965	0.48816
8.....	0.79959	0.74678	0.71467	0.69080	0.67265	0.62809	0.60662	0.58383	0.55292	0.52203
9.....	0.81694	0.76819	0.73854	0.71652	0.69976	0.65778	0.63734	0.61530	0.58527	0.55516
10.....	0.83314	0.78839	0.76117	0.74095	0.72557	0.68627	0.66694	0.64574	0.61672	0.58754
11.....	0.84833	0.80749	0.78266	0.76421	0.75017	0.71365	0.69548	0.67519	0.64730	0.61918
12.....	0.86256	0.82556	0.80306	0.78633	0.77361	0.73992	0.72297	0.70365	0.67697	0.65002
13.....	0.87589	0.84328	0.82344	0.80870	0.79749	0.76689	0.75116	0.73264	0.70693	0.68090
14.....	0.88772	0.85920	0.84186	0.82897	0.81916	0.79161	0.77715	0.75958	0.73511	0.71031
15.....	0.89926	0.87456	0.85954	0.84838	0.83990	0.81537	0.80222	0.78571	0.76263	0.73921
16.....	0.91045	0.89005	0.87707	0.86725	0.85969	0.83814	0.82634	0.81097	0.78941	0.76751
17.....	0.92126	0.90473	0.89368	0.88518	0.87855	0.85994	0.84949	0.83534	0.81539	0.79513
18.....	0.93167	0.91855	0.90937	0.90218	0.89652	0.88076	0.87169	0.85880	0.84055	0.82201
19.....	0.94164	0.93156	0.92416	0.91829	0.91362	0.90065	0.89294	0.88135	0.86485	0.84811
20.....	0.95115	0.94378	0.93811	0.93355	0.92989	0.91963	0.91327	0.90300	0.88829	0.87339
21.....	0.96019	0.95524	0.95126	0.94801	0.94538	0.93776	0.93273	0.92379	0.91088	0.89784
22.....	0.96870	0.96595	0.96365	0.96175	0.96021	0.95510	0.95137	0.94378	0.93272	0.92160
23.....	0.97647	0.97484	0.97341	0.97222	0.97124	0.96781	0.96513	0.95938	0.95113	0.94280
24.....	0.98394	0.98310	0.98234	0.98170	0.98117	0.97916	0.97745	0.97326	0.96721	0.96113

Source: United Nations (1983) Manual X