UNIVERSITY OF SWAZILAND

DEPARTMENT OF STATISTICS AND DEMOGRAPHY

MAIN EXAMINATION 2018

TITLE OF PAPER	:	INDIRECT TECHNIQUES OF DEMOGRAPHIC ESTIMATION II
COURSE CODE	:	DEM 314
TIME ALLOWED	:	TWO (2) HOURS
INSTRUCTIONS	:	ANSWER QUESTIONS 1, 2, 3 AND EITHER 4 OR 5 SHOW ALL YOUR WORKINGS INCLUDING FORMULAE WHERE APPLICABLE.
REQUIREMENTS	:	CALCULATOR

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

Question 1 [20]

Using census data for Country C in year 2002 shown in Table E1, a demographer estimated male child mortality using the Brass Children Ever Born-Children Surviving technique as displayed in Tables E1 and E2. 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 E1 Data observed for Country C required for Brass Children Ever Born: Children Surviving technique computations

Age group	Index	W_i	CEB_i	CS_i	CD_i	P_i	D_i
15-19	1	766882	69352	64317	--------	0.0904	--------
20-24	2	658857	347375	319447	27928	--------	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	47231	2.0652	0.0851
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**			

Table E2 Brass Children Ever Born: Children Surviving technique

Age i	K_i	Age x	q_x	t_x	Reference date	l_x	Mortality level
15-19	1.0400	1	0.07551	1.0354	2001.7	0.92449	17.3
20-24	--------	2	--------	----------	2000.4	--------	------
25-29	0.9347	3	0.08022	4.2615	1998.5	0.91978	18.7
30-34	0.9705	5	0.08246	6.5338	1996.2	0.91754	19.2
35-39	1.0328	10	0.08787	9.0691	1993.7	0.91213	19.6
40-44	1.0203	15	0.10104	11.7851	1991.0	0.89896	19.3
45-49	1.0030	20	0.11952	14.6755	1988.1	0.88048	19.0

Given the data provided Tables E1 and E2 and appropriate Life Tables in the Appendix.

a) Define the parameters CD_i, P_i, D_i, q_x, t_x, and l_x in Tables E1 and E2 [6]
b) Fill in the blank spaces in Table E1 and Table E2 [12]
c) 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.

Question 2 [20]

A demographer fitted a two-parameter Brass relational model life table from data observed in Country B in a certain year. The data showing the life table of mortality experience for Country B is shown in Table E2.

Table E2 Life table of mortality experience of Country B

Age	Standard		[redacted]		Fitted	
X	lx	logit lx	lx	logit lx	logit lx	lx
0	1		1			[redacted]
1	0.913	-1.175	0.932	[redacted]	-1.4104	[redacted]
5	0.725	-0.485	0.804	[redacted]	-0.6120	[redacted]
10	0.7	-0.424	0.792	[redacted]	-0.5414	[redacted]
15	0.682	-0.381			-0.4927	0.728
20	0.658	-0.327			-0.4299	0.703
25	0.629	-0.264			-0.3568	0.671
30	0.598	-0.199			-0.2812	0.637
35	0.564	-0.129			-0.2005	0.599
40	0.53	-0.060			-0.1211	0.560
45	0.494	0.012			-0.0378	0.519
50	0.457	0.086			0.0480	0.476
55	0.412	0.178	0.392	[redacted]	0.1539	[redacted]
60	0.361	0.286	0.335	[redacted]	0.2783	[redacted]
65	0.295	0.436	0.281	[redacted]	0.4518	[redacted]
70	0.222	0.627	0.216	[redacted]	0.6731	[redacted]
75	0.145	0.887			0.9738	0.125
80	0.076	1.249			1.3921	0.058
85	0.029	1.756			1.9776	0.019
			Alpha	[redacted]		
			Beta	[redacted]		

Using the data in Table E2 and showing your answers for the provided spaces in the same Table:

i. Compute the logit lx values for the observed data provided? [4]

ii. Determine the parameters alpha (α) and beta (β) in a Brass logit model life table fitted to all the data provided above. [12]

iii. Derive a fitted life table using the parameters derived in part b) and the standard provided. [4]

ANSWER EITHER

Question 3 **[20]**

a. Explain what is meant by i) empirical models and ii) relational models [4]

b. State any two uses of model life tables; [2]

c. What is the advantage of using relational over empirical model life tables; [2]

d. Briefly explain the patterns of the Coale and Demeny model life tables; [12]

OR

Question 4 **[20]**

Write brief, but critical notes on the purpose, data required, assumptions and limitations of the **TWO** following indirect estimation methods.

a. Orphanhood method [10]

b. Preston and Coale method [10]

APPENDIX

$$F(7) = \phi(6) + a(7)f(7) + b(7)f(6) + c(7)\phi(7)$$

$$f^{+}(i) = (1 - w(i-1))f(i) + w(i)f(i+1)$$

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

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

$$f^{+}(7) = (1 - w(6))f(7)$$

Table A1:Table Coefficients for F(i)

Age group	a(i)	b(i)	c(i)
15-19	2.531	-0.188	0.0024
20-24	3.321	-0.754	0.0161
25-29	3.265	-0.627	0.0145
30-34	3.442	-0.563	0.0029
35-39	3.518	-0.763	0.0006
40-44	3.862	-2.481	-0.0001
45-49	3.828	0.016*	-0.0002

Table A2: Table Coefficients for $f^{+}(i)$

Age group	x(i)	y(i)	z(i)
15-19	0.031	2.287	0.114
20-24	0.068	0.999	-0.233
25-29	0.094	1.219	-0.977
30-34	0.12	1.139	-1.531
35-39	0.162	1.739	-3.592
40-44	0.27	3.454	-21.497

Table A3: 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 A4: 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

	Probability of surviving from birth, l(x)									
Level	*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