

UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER 2008

**TITLE OF PAPER : QUANTITATIVE METHODS IN
DEMOGRAPHY**

COURSE CODE : DEM 206

TIME ALLOWED : 2 (TWO) HOURS

**REQUIREMENTS : STATISTICAL TABLES AND
CALCULATOR**

INSTRUCTIONS : ANSWER ANY THREE (3) QUESTIONS

**THIS PAPER IS NOT TO BE OPENED UNTIL PERMISSION HAS
BEEN GRANTED BY THE INVIGILATOR**

QUESTION ONE

[20 marks, 4+4+4+4+4]

A French language teacher gives a test written in French, consisting of 4 multiple choice questions with four possible answers on each, only one which is correct. An African languages student wanders in and mistakenly takes the test and cannot even read the questions, but just marks the answers at random. A score of 50% is required to pass the test.

- a. What is the probability that the African languages student passes the test?
- b. Given that he passes the test, what is the probability that he gets 100% right?
- c. What is the probability that he will miss questions 2 and 4, and will get 1 and 3 right?
- d. What is the probability that the student will get exactly 3 questions right if there were 5 questions on the test?
- e. Let the random variable X denote the number of questions the student gets right. Write down the discrete probability distribution for X and then compute its mean and variance.

QUESTION TWO

[20 marks, 10+10]

- a. A husband and wife are each 70 years old. The probability that the husband will die sometimes this year is 0.10, and the probability that the wife will die this year is 0.05. The probability that the husband will die this year given that his wife has died is 0.40.
 - i. What is the probability that at least one of them will die this year?
 - ii. What is the probability that the wife will die, given that the husband has died?
- b. When a pair of fair dice is thrown, the score (X) is calculated as the sum of the two numbers showing. Your payoff is 49 minus the square of the score.
 - i. What is the expected score?
 - ii. What is your expected payoff?

QUESTION THREE

[20 marks, 5+5+5+5]

The length of human pregnancies is normally distributed with mean $\mu=266$ days and standard deviation $\sigma=16$ days.

- a. What is the percentage of pregnancies that last more than 270days?
- b. A "very preterm" baby is one where the gestation period is less than 244days. What proportion of births are "very preterm"?
- c. Suppose an unusually long pregnancy is one that is in the top 2%. Determine the length of pregnancy that separates unusually long pregnancy from one that is not unusually long.
- d. Determine the length of pregnancy that would be considered typical if we define typical to be the middle 96% of pregnancies.

QUESTION FOUR

[20 marks, 5+5+5+5]

- a. The probability that persons inquiring about room will want to take a room at the Isicholo hotel is 0.25. If the hotel has only 3 vacancies, what is the probability that after 20 people inquire, the hotel will not be full.
- b. A telephone switchboard can handle at most 5 incoming calls a minute. If past experience shows that an average of 120 calls per hour are received by the switchboard. Find the probability that the switchboard is overloaded during any given minute.
- c. The probability that a 20 year old man lives through another year is 0.999. Assuming that the probability remains the same for the next 10 years, what is the probability that the man will die within the next five years?

- d. A and B decide to meet between 12 and 1pm but that each should wait no longer than 5 minutes for the other. Determine the probability that they meet.

QUESTION FIVE

[20 marks, 8+8+4]

A researcher believes that as age increases, the grip strength (in pounds per square inch) of an individual's dominant hand decreases. From a random sample of 17 females, he obtains the following data:

Age	Grip Strength	Age	Grip Strength
16	60	37	58
61	60	43	73
43	66	53	60
25	75	68	30

Source: Kevin McCarthy, Student at Jolien Junior College

- Use the data to calculate the correlation coefficient and the coefficient of determination between the two variables and interpret.
- Compute the least squares regression line of grip strength by age.
- According to the regression line, what would be a good guess as to the grip strength of a randomly selected 42 year old?

Table 4. Normal curve areas.
Standard normal probability to right-hand tail.
(For negative values of z return from symmetry.)



z		Standard deviation planes of z									
.00	.01	.02	.03	.04	.05	.06	.07	.08	.09		
0.0	.0000	.4980	.4970	.4960	.4950	.4940	.4930	.4920	.4910	.4900	
0.1	.4608	.4599	.4590	.4582	.4573	.4564	.4556	.4547	.4538	.4529	
0.2	.4307	.4299	.4290	.4282	.4273	.4264	.4256	.4247	.4238	.4229	
0.3	.4087	.4079	.4070	.4062	.4053	.4044	.4036	.4027	.4018	.4009	
0.4	.3944	.3936	.3928	.3919	.3910	.3901	.3893	.3884	.3875	.3866	
0.5	.3805	.3797	.3789	.3780	.3771	.3762	.3754	.3745	.3736	.3727	
0.6	.3673	.3665	.3657	.3648	.3639	.3631	.3622	.3613	.3604	.3595	
0.7	.3543	.3535	.3527	.3518	.3509	.3501	.3492	.3483	.3474	.3465	
0.8	.3413	.3405	.3397	.3388	.3379	.3371	.3362	.3353	.3344	.3335	
0.9	.3285	.3276	.3268	.3259	.3250	.3241	.3232	.3223	.3214	.3205	
1.0	.3156	.3147	.3139	.3130	.3121	.3112	.3103	.3094	.3085	.3076	
1.1	.3027	.3018	.3009	.3000	.2991	.2982	.2973	.2964	.2955	.2946	
1.2	.2897	.2888	.2879	.2870	.2861	.2852	.2843	.2834	.2825	.2816	
1.3	.2767	.2758	.2749	.2740	.2731	.2722	.2713	.2704	.2695	.2686	
1.4	.2637	.2628	.2619	.2610	.2601	.2592	.2583	.2574	.2565	.2556	
1.5	.2506	.2497	.2488	.2479	.2470	.2461	.2452	.2443	.2434	.2425	
1.6	.2375	.2366	.2357	.2348	.2339	.2330	.2321	.2312	.2303	.2294	
1.7	.2244	.2235	.2226	.2217	.2208	.2199	.2190	.2181	.2172	.2163	
1.8	.2113	.2104	.2095	.2086	.2077	.2068	.2059	.2050	.2041	.2032	
1.9	.2082	.2073	.2064	.2055	.2046	.2037	.2028	.2019	.2010	.2001	
2.0	.1951	.1942	.1933	.1924	.1915	.1906	.1897	.1888	.1879	.1870	
2.1	.1820	.1811	.1802	.1793	.1784	.1775	.1766	.1757	.1748	.1739	
2.2	.1688	.1679	.1670	.1661	.1652	.1643	.1634	.1625	.1616	.1607	
2.3	.1566	.1557	.1548	.1539	.1530	.1521	.1512	.1503	.1494	.1485	
2.4	.1443	.1434	.1425	.1416	.1407	.1398	.1389	.1380	.1371	.1362	
2.5	.1320	.1311	.1302	.1293	.1284	.1275	.1266	.1257	.1248	.1239	
2.6	.1198	.1189	.1180	.1171	.1162	.1153	.1144	.1135	.1126	.1117	
2.7	.1076	.1067	.1058	.1049	.1040	.1031	.1022	.1013	.1004	.0995	
2.8	.0954	.0945	.0936	.0927	.0918	.0909	.0900	.0891	.0882	.0873	
2.9	.0831	.0822	.0813	.0804	.0795	.0786	.0777	.0768	.0759	.0750	
3.0	.0709	.0700	.0691	.0682	.0673	.0664	.0655	.0646	.0637	.0628	
3.1	.0587	.0578	.0569	.0560	.0551	.0542	.0533	.0524	.0515	.0506	
3.2	.0465	.0456	.0447	.0438	.0429	.0420	.0411	.0402	.0393	.0384	
3.3	.0343	.0334	.0325	.0316	.0307	.0298	.0289	.0280	.0271	.0262	
3.4	.0221	.0212	.0203	.0194	.0185	.0176	.0167	.0158	.0149	.0140	
3.5	.0100	.0091	.0082	.0073	.0064	.0055	.0046	.0037	.0028	.0019	
4.0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	
4.5	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	
5.0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	

From B. L. Wahlgren, *Introduction to Statistics* (New York: Macmillan, 1948).

Table 5. Percentage points of the χ^2 -distribution.

χ^2	χ^2	χ^2	χ^2	χ^2	χ^2	df
2.70554	3.84146	5.02389	6.63489	7.87944	9.48774	1
4.60517	5.99147	7.37776	9.21004	10.59664	12.00081	2
6.55139	7.87944	9.48773	11.57854	13.81617	16.01278	3
7.77944	9.48773	11.57854	13.81617	16.01278	19.02281	4
9.34835	11.07050	12.83253	15.08825	17.53457	21.45429	5
10.64466	12.59154	14.44944	16.81191	19.36751	23.68479	6
12.01770	14.06711	16.08711	18.54743	21.45429	26.15397	7
13.36156	15.56160	17.82280	20.42149	23.68479	28.77842	8
14.68277	16.91900	19.67510	22.53743	26.15397	31.52641	9
15.98771	18.30700	21.66431	24.72499	28.77842	34.42960	10
17.27483	19.67510	23.58133	27.00052	31.52641	37.56615	11
18.54944	21.02943	25.56408	29.52361	34.42960	40.75948	12
19.81189	22.36472	27.65790	32.16257	37.56615	44.15424	13
21.06424	23.68479	29.81953	34.90104	40.75948	47.77915	14
22.30772	24.99579	32.00052	37.66430	44.15424	51.67584	15
23.54118	26.29615	34.20161	40.52894	47.77915	55.81859	16
24.75980	27.58711	36.41513	43.48032	51.67584	60.19020	17
25.96844	28.86943	38.57922	46.56438	55.81859	64.77883	18
27.20564	30.14355	40.78304	49.66031	60.19020	69.57484	19
28.41320	31.41044	43.02839	52.77901	64.77883	74.56738	20
29.61511	32.67123	45.31554	55.91224	69.57484	79.75734	21
30.81133	33.91688	47.64538	59.15144	74.56738	85.15512	22
32.00899	35.16743	49.99491	62.51661	79.75734	90.77231	23
33.19883	36.41288	52.33931	65.90814	85.15512	96.57931	24
34.38116	37.65324	54.66854	69.32544	90.77231	102.56561	25
35.55691	38.88854	57.02391	72.76814	96.57931	108.72211	26
36.74412	40.11883	59.34544	76.23661	102.56561	115.03981	27
37.91219	41.34411	61.69291	79.72144	108.72211	121.51911	28
39.08075	42.56440	64.06644	83.22311	115.03981	128.16011	29
40.25080	43.77969	66.46691	86.74144	121.51911	134.96311	30
41.42144	44.99000	68.89444	90.27661	128.16011	141.92811	40
42.59269	46.19531	71.34891	93.82814	134.96311	149.05511	50
43.76444	47.39561	73.83144	97.39561	141.92811	156.34511	60
44.93669	48.59091	76.34291	100.97814	149.05511	163.79811	70
46.10944	49.78122	78.88344	104.57661	156.34511	171.41311	80
47.28269	50.96651	81.45391	108.19114	163.79811	179.19011	90
48.45644	52.14681	84.05844	111.82161	171.41311	187.12911	100

From "Tables of the Percentage Points of the χ^2 -Distribution," *Biometrika*, Vol. 33 (1946), pp. 188-189.
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