

UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER 2007/08

TITLE OF PAPER: QUANTITATIVE METHODS IN DEMOGRAPHY

COURSE CODE : DEM 206

TIME ALLOWED : TWO (2) HOURS

**INSTRUCTIONS : THIS PAPER HAS FIVE QUESTIONS. ANSWER
 ANY THREE (3) QUESTIONS**

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GRANTED BY THE INVIGILATOR**

QUESTION 1 (8+6+6 marks)

- a. The probability that a man will be alive in 25 years is $\frac{3}{5}$, and the probability that his wife will be alive in 25 years is $\frac{2}{3}$. Find the probability that in 25 years:
- both will be alive;
 - only the man will be alive;
 - only the wife will be alive; and
 - at least one will be alive.
- b. Out of 500 families with 4 children each, what percentage would be expected to have:
- 2 boys and 2 girls;
 - at least one boy; and
 - at most 2 girls?
- Assume equal probabilities for boys and girls.
- c. A recent study of robberies for a certain geographic region showed an average of one robbery per 20,000 people. In a city of 80,000 people, find the probability of the following:
- At least one robbery?
 - At most two robberies?

QUESTION 2 (8+9+3 marks)

The number of claims per quarter on life policies submitted to an insurance company is as follows:

Year	Q1	Q2	Q3	Q4
2003	84	53	60	75
2004	81	57	51	73
2005	69	37	40	77
2006	73	46	39	63

- Find the trend for the above data.
- De-seasonalize the claims data.
- Comment on the seasonal influences.

QUESTION 3 (6+6+8 marks)

- a. Records show that the probability is 0.0004 that a car will break down while driving through a certain tunnel. Use the Poisson approximation to the binomial distribution to determine the probability that among 2,000 cars driving through the tunnel at most two will break down.
- b. If 23 percent of all patients with high blood pressure have side effects from a certain kind of medicine, use the normal approximation to find the probability that among 120 patients with high blood pressure treated with this medicine more than 32 will have bad side effects.
- c. An IQ scale has approximately a normal distribution with a mean of 100 and a standard deviation of 16.
 - i. What proportion of people has an IQ of at most 120?
 - ii. What proportion of people has an IQ of between 84 and 96?

QUESTION 4 (8+6+6 marks)

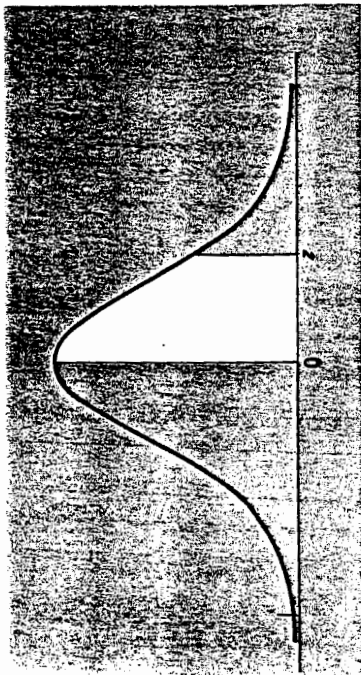
- a. The manufacturer of a patent medicine claimed that it was 90% effective in relieving an allergy for a period of 8 hours. In a sample of 200 people who had the allergy, the medicine provided relief for 160 people. Determine whether the manufacturer's claim is legitimate using a level of significance of 0.01.
- b. A coin which is tossed 35 times comes up heads 20 times. Can we conclude at significance level 0.01 that the coin is not fair?
- c. In the past, a golfer has averaged 81 on a certain course. If, with a new set of clubs, she averages 78 over 36 rounds with a standard deviation of 2.6, what can we conclude at the level of significance 0.05 about the effect of the new clubs?

QUESTION 5 (8+4+8 marks)

- d. A study is done to see whether there is a relationship between a mother's age and the number of children she has. The data are shown below.

Number of children	2	1	3	1	2	4	3	5
Mother's age	18	22	29	20	27	32	33	36

- i. Predict the number of children of a mother whose age is 34.
- ii. How important is age in explaining the differences in the number of children the women bear?
- b. A study on crime suggested that at least 40% of all arsonists were under 21 years of age. Checking local crime statistics, a researcher found that 30 out of 80 arson suspects were under 21 years. At $\alpha = 0.01$, should the crime statistics be rejected?



The entries in Table I are the probabilities that a random variable having a standard normal distribution takes on a value between 0 and z ; they are given by the area of the white region under the curve in the figure shown above.

TABLE I Normal-Curve Areas

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4978	.4979	.4979	.4980	.4981	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

Also, for $z = 4.0, 5.0,$ and $6.0,$ the areas are $0.49997, 0.499997,$ and $0.499999999.$