UNIVERSITY OF SWAZILAND

SUPPLEMENTARY EXAMINATION PAPER 2005

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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QUESTION 1

a. The probabilities that the serviceability of a new X-ray machine will be rated very difficult, difficult, average, easy, or very easy are, respectively, 0.12, 0.17, 0.34, 0.29, and 0.08. Find the probabilities that the serviceability of the machine will be rated:
   i. difficult or very difficult;
   ii. neither very difficult nor very easy;
   iii. average or worse;
   iv. average or better.

b. For married couples living in a certain suburb, the probability that the husband will commit adultery is 0.21, the probability that his wife do the same is 0.28, and the probability that both will commit adultery is 0.15. What is the probability that at least one of them will commit adultery?

c. If three persons, selected at random, are stopped on a street, what are the probabilities that:
   i. all were born on a Friday;
   ii. two were born on a Friday and the other on a Tuesday;
   iii. none were born on a Monday?

QUESTION 2

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 3

a. A motor car manufacturer purchases gear assemblies from a sub-contractor who undertakes to ensure that no more than 5 percent of his supplies will be defective.

In order to provide a check on the quality of incoming supplies a random sample of 200 assemblies is selected of which 17 are found to be defective.

Construct an interval estimate of the proportion of all the sub-contractor's supplies that are defective. Use a confidence level of 99 %.

b. Explain the differences between the following in full:

i. mutually exclusive events vs independent events;

ii. sampling error vs. non sampling error;

iii. point estimates vs. interval estimates;

iv. parameter vs statistic.

QUESTION 4

Random samples of size 2 are drawn from the finite population which consists of the numbers 5, 6, 7, 8, 9, and 10.

a. Compute the population mean and standard deviation.

b. List all the possible random samples of size 2 that can be drawn form this finite population and calculate their means.

c. Construct the sampling distribution of the mean for random samples of size 2 from this given population.

d. Calculate the mean and standard deviation of the sampling distribution.

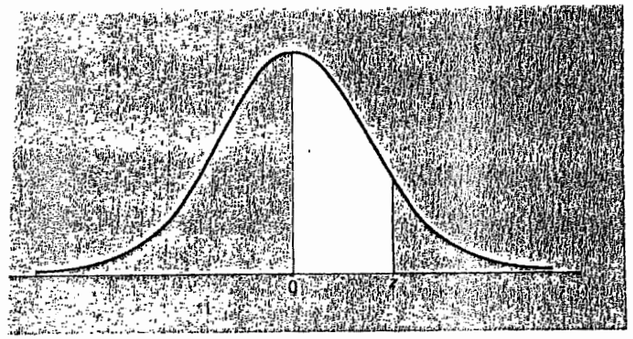
QUESTION 5

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?



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

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	.4977	.4978	.4979	.4979	.4980	.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, 0.4999997, and 0.499999999.