UNIVERSITY OF SASKATCHEWAN

Department of Mathematics & Statistics

Stat 103.3 Final Exam

Date: Dec. 20, 2005   **Time**: 3 hours   **Instructor**: Qingde Yang

Closed Book, No Notes

One formula sheet and one Calculator are allowed.

- ❖ **PRINT** your name clearly and write your student ID number on the opscan sheet.
- ❖ Encode your student ID number on the opscan sheet.
- ❖ All questions are of equal value.
- ❖ Encode your answers carefully on the opscan sheet. Mark only one answer; otherwise the answer will be counted as incorrect. In case there is more than one answer; mark the best answer.

Problem: An urn contains 10 balls labelled 1, 2, ..., 10. Suppose one ball is drawn at random from the urn. Define the following events:

A = "the number on the ball is an even number"

B = "the number on the ball is among the first five numbers"

C = "the number on the ball is one of the last three numbers"

Find the following probabilities:

[1]. $P(B \cup C)$

[2]. $P(\overline{A \cap B})$

Answer choices for questions 1-2 are:

(A) 0.7	(B) 0.2	(C) 0.3
(D) 0.1	(E) 0.6	(F) 0.4
(G) 0.8	(H) 0.9	(I) 0.5
(J) None of the above		

Problem: Concerning the events A and B, the following probabilities are given.

$$P(B) = \frac{1}{3}, \quad P(A \mid B) = \frac{2}{3}, \quad P(A \mid \overline{B}) = \frac{3}{7}$$

[3]. Find $P(A\overline{B})$

[4]. Find $P(A)$

[5]. Find $P(\overline{B} \mid A)$

Answer Choices for question 3-5 are:

(A) 0.2857   (B) 0.5760   (C) 0.5600   (D) 0.4832   (E) 0.5625   (F) 0.3602   (G) 0.40320

(H) 0.8201   (I) 0.5079   (J) None of the above

Problem: To determine whether consumers favour a new product, a company conducts a consumer survey in which a total of 425 customers are asked to try the product and tell their opinions. The finding is listed in the table below. A person is randomly selected from this group,

	Like it	Does not like it	No opinion	Total
Men	56	120	14	190
Women	130	70	35	235
Total	186	190	49	425

[6]. Find the probability that the person selected is a man and likes the product.

[7]. Find the probability that the person selected is a woman or likes the product.

[8]. If we are told that the person selected is a woman, then what is the probability that she does not like the product?

Answer choices for questions 6-8 are:
   (A) 0.2979   (B) 0.1318   (C) 0.1333   (D) 0.6847
   (E) 0.2525   (F) 0.1325   (G) 0.3825   (H) 0.6500
   (I) 0.3431   (J) None of the above

Problem: Suppose there are two boxes. Box 1 contains 20 articles, of which 6 are defective, and box 2 contains 30 articles, of which 5 are defective. Experiment: one article is randomly selected from each box. Assume that the selections from the two boxes are independent. Let X denote the total number of defective articles obtained.

[9]. The possible values of X are:
Answer choices for question 9 are:
(A) 1,2,3,4,5,6,7,8,9,10,11   (B) 0,1,2,3,4,5,6,7,8,9,10,11   (C) 1,2,3,4,5,6
(D) 0,1,2,3,4,5,6   (E) 0,1,2,3,4,5   (F) 1,2,3,4,5
(G) 0,1,2   (H) 1,2   (I) 2,4
(J) None of the above

[10]. Find the probability distribution of X and use it to find the probability of observing at least one defective article.
Answer choices for question 10 are:
(A) 0.5833   (B) 0.6667   (C) 0.3333
(D) 0.4315   (E) 0.2133   (F) 0.4167
(G) 0.3155   (H) 0.0500   (I) 0.1400
(J) None of the above

[11]. Find the mean μ_X.
Answer choices for question 11 are:
(A) 3.5000   (B) 2.5000   (C) 1.3450
(D) 1.6667   (E) 0.4667   (F) 0.5556
(G) 1.4500   (H) 0.3415   (I) 0.7454
(J) None of the above

[12]. How many different numbers can be formed from the digits 5,6,6,7,7,7,8,8, if we use them all?

[13]. A sociology professor assigned 5 problems from Unit One, 10 problems from Unit Two, and 8 problems from Unit Three for next Wednesday and announced that she will grade only 2 of the assigned problems from Unit One, 4 of those from Unit Two, and 3 from Unit Three. How many different ways can she choose the problems that she will grade?

[14]. A computer password is to consist of 4 alphanumeric characters with no repeats (An alphanumeric character is a letter from A to Z or digit from 0 to 9.) How many such passwords are there if the letter O and the digit 0 are excluded to avoid confusion?

[15]. You have a penny, a nickel, a dime, a quarter, a half-dollar, and a dollar in your pocket. How many different amounts of money can you make?

[16]. How many five-card hands from a standard deck of 52 cards will contain only cards of the same suit?

[17]. In how many ways can the letters of the word **STATISTICS** be arranged?

Choices for questions 12-17 are:
(A)1287	(B)1680	(C)63
(D)117600	(E)2598960	(F)5148
(G)50400	(H)1113024	(I) 1235

(J) None of the above.

Problem: Records kept by Saskatchewan Health indicate that the heights of two-year-old boys are normally distributed with mean = 34.5 inches and standard deviation = 1.3 inches.

[18]. If one such child is selected at random, what is the probability that its height is between 33.5 to 35.5 inches?

[19]. If one such child is selected at random, what is the probability that its height is greater than 36.5 inches?

Choices for questions 18-19 are:
(A) 0.3571	(B) 0.5588	(C) 0.8634
(D) 0.3664	(E) 0.0618	(F) 0.0535
(G) 0.3329	(H) 0.8764	(I) 0.1333

(J) None of the above.

[20]. Let $\overline{X}$ be the sample mean of a random sample of 4 children, what is the distribution of $\overline{X}$?

[21]. What is the probability that $\overline{X}$ will be between 33.5 to 35.5 inches?

[22]. To determine the reason for growth, those children in the top 10% of heights are examined. What is the minimum height that is in the top 10%.

[23]. If 6 two-year-old boys are randomly selected, what is the probability that all heights of them are less than 36 inches?

Choices for questions (1) to (3) are:
(A)35.371	(B)0.5588	(C) It's normal
(D)36.164	(E)0.0618	(F) It's not normal
(G)33.629	(H)0.8764	(I) 0.4485

(I) None of the above.

Problem:

[24]. In a town, 60% of the citizens are Republicans and 40% are Democrats. In the last election 55% of the Republicans voted and 65% of the Democrats voted. If a voter is randomly selected, what is the probability that the person is a Republican?

[25]. Suppose that at a certain accounting office 30%, 25%, and 45% of the statements are prepared by Ms. Jones, Ms. Lane, and Ms. Brown, respectively. These employees are very reliable. Nevertheless, they are in error some of the time. Suppose that 1%, 0.5%, and 0.3% of the statements prepared by Ms. Jones, Ms. Lane, and Ms. Brown, respectively, are in error. If a statement from the accounting office is in error, what is the probability that it was prepared by Ms. Jones?

Choices for questions 24-25 are:
(A) 0.536   (B) 0.330   (C) 0.441
(D) 0.466   (E) 0.223   (F) 0.559
(G) 0.260   (H) 0.241   (I) 0.333
(J) None of the above.

Problem: A book has 200 pages and 200 misprints distributed at random. Assume that these misprints follow a Poisson distribution.

[26]. What is the probability that a page contains exactly two misprints?

[27]. What is the probability that a page contains fewer than two misprints?

[28]. What is the probability of exactly two misprints on two pages?

Answer choices for questions 6-8 are:
(A) 0.2979   (B) 0.1318   (C) 0.1839   (D) 0.6847
(E) 0.2525   (F) 0.7356   (G) 0.3679   (H) 0.6500
(I) 0.3431   (J) None of the above

Problem: A manufacturer of automobile batteries claims: The distribution of the length of life X of its battery has: $\mu_X = 54$ months, $\sigma_X = 6$ months. Suppose a customer group decides to check the claim by purchasing a sample of 50 of these batteries and subjecting them to tests that determine their lives.

[29]. Assume that the manufacturer's claim it true, what is the probability that the customer group's sample has a mean life of 52 months or few months?

Answer choices for question are:
(A) 0.0279   (B) 0.0003   (C) 0.1200   (D) 0.0047
(E) 0.0025   (F) 0.0056   (G) 0.1367   (H) 0.0091
(I) 0.0310   (J) None of the above

Problem: Based on SGI records, 20% of Saskatchewan drivers are termed to be "accident-prone" since they tend to be involved in traffic accidents much more frequently than the norm.

[30]. If a sample of 12 drivers is selected at random from all Saskatchewan drivers, what is the probability that exactly 3 drivers are accident-prone drivers?

[31]. If a sample of 12 drivers is selected at random from all Saskatchewan drivers, what is the probability that no more than 11 drivers are non-accident-prone drivers?

[32]. A sample of 200 drivers is selected at random from all Saskatchewan drivers. What is the probability that more than 35 of the selected drivers are "accident-prone"?

[33]. A sample of 200 drivers is selected at random from all Saskatchewan drivers. What is the probability that at least 42 but at most 47 (i.e., between 42 and 47 inclusively) of the selected drivers are "accident-prone"?

Answer choices for questions 30-33 are:

(A) 0.2382	(B) 0.3018	(C) 0.2362	(D) 0.4735
(E) 0.2582	(F) 0.0667	(G) 0.7881	(H) 0.5437
(I) 0.6255	(J) None of the above		

Problem: Imagine you are purchasing small lots of a manufactured product. If it is very costly to test a single item, it may be desirable to test a sample of items from the lot instead of testing every item in the lot. Suppose each lot contains 10 items. You decide to sample four items per lot and reject the lot if you observe one or more defectives.

[34]. If the lot contains one defective item, what is the probability that you will accept the lot?

[35]. What is the probability that you will accept the lot if it contains two defective items?

[36]. If the lot contains two defective items, what is the expected value of the number of the defective items in each sample?

[37]. Now imagine that you change your mind. Instead of testing a sample of 4 items from the lot, you test every item in the lot one after one. If the lot contains 2 defective items among 10 items, what is the probability that the first defective item comes on the fourth test?

Answer choices for questions 30-33 are:

(A) 0.6000	(B) 0.1333	(C) 0.4362	(D) 0.3333
(E) 0.0345	(F) 0.1024	(G) 0.8881	(H) 0.1254
(I) 0.8000	(J) None of the above		

Problem: The number of eggs a female house fly lays during her lifetime is normally distributed, with a mean of 800 eggs and a standard deviation of 100 eggs. Random samples of size 15 are drawn from this population. Let $X_1, X_2, \cdots, X_{15}$ be the numbers of eggs for the selected flies. Let $\overline{X} = \dfrac{X_1 + X_2 + \cdots X_{15}}{15}$.

[38]. Determine the value of $\mu_{\overline{X}}$.

[39]. Determine the value of $\sigma_{\overline{X}}$.

[40]. Find $P(750 \le \overline{X} \le 810)$.

Answer choices for question are:

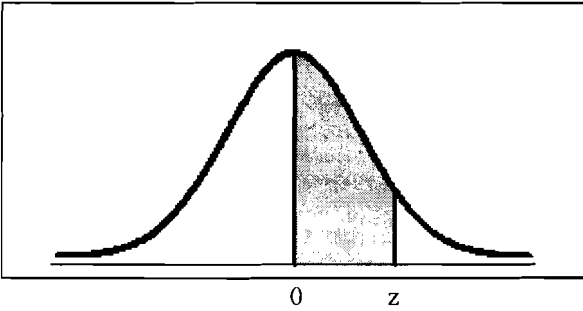|			
(A) 0	(B) 100	(C) 800	(D) 0.4735
(E) 25.82	(F) 6.67	(G) 0.3535	(H) 0.5437
(I) 0.6255	(J) None of the above		

* * * THE END * * *

TABLE of the STANDARD NORMAL DISTRIBUTION

"Cell" entries are areas under the N(0,1) curve between *0* and the *z*-value

NOTE: In calculating a *z*-value before entering these tables, always **round** the value correctly to two places of decimal.

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998