

STATISTICS-OPEN LEVEL
2000 Mu Alpha Theta National Convention

1. A mill makes castings containing a hole which is specified to have diameter 6 cm. Due to variability in the manufacturing process the actual diameter is a normal random variable with mean 6 cm and standard deviation 0.25 cm. What proportion of these castings have hole diameter within 0.5 cm of the specifications (6 cm)?

- (a) .7803
- (b) .9544
- (c) .0456
- (d) .4456
- (e) NOTA

2. The heights of American men aged 18 to 24 are approximately normally distributed with mean 68 inches and standard deviation 2.5 inches. Only about 5% of young men have heights outside the range

- (a) 65.5 inches to 70.5 inches
- (b) 60.5 inches to 75.5 inches
- (c) 63 inches to 73 inches
- (d) 58 inches to 78 inches
- (e) NOTA

3. You record the age, marital status, and earned income of a sample of 1489 women. The number of variables you have recorded is

- (a) 1489
- (b) four—age, marital status, income, and number of women
- (c) three—age, marital status, and income
- (d) two—age and income
- (e) NOTA

4. A standardized test designed to measure math anxiety has a mean of 100 and a standard deviation of 10 in the population of first year college students. Which of the following observations would you suspect is an outlier?

- (a) 150
- (b) 100
- (c) 90
- (d) all of the above
- (e) NOTA

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

Table A

Table A Continued (p. 799)

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5. The length of pregnancy from conception to natural birth among white females is a normally distributed random variable with mean 270 days and standard deviation 10 days. What is the proportion of pregnancies that last over 300 days?

- (a) .0773
- (b) .9772
- (c) .3489
- (d) .0013
- (e) NOTA

6. Scores on the Wechsler Adult Intelligence Scale (a standard "IQ" test) for people aged 20 to 34 are normally distributed with mean 110 and standard deviation 25. Julie only wants to date men in the top 25% on this intelligence scale. How high must a man score for Julie to date him?

- (a) 127
- (b) 134
- (c) 116
- (d) 142
- (e) NOTA

7. Month-to-month data for production of cottage cheese x (millions of pounds) and ice cream y (millions of gallons) for a recent year are collected and give the following regression line.

$$\hat{y} = -29.5 + 1.4x$$

If the cottage cheese production in one month is 78.2 million pounds, what is the expected value of the ice cream production in millions of gallons?

- (a) 57.0 million gallons
- (b) 80.0 million gallons
- (c) 23.0 million gallons
- (d) 65.5 million gallons
- (e) NOTA

8. A study found correlation $r = .61$ between the sex of a worker and his or her income. You conclude that

- (a) women earn more than men on the average
- (b) women earn less than men on the average
- (c) an arithmetic mistake was made; this is not a possible value of r
- (d) this is nonsense because r makes no sense here
- (e) NOTA

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9. A least squares regression line is fitted to the weights (in kilograms) of a group of children between the ages of 12 and 36 months. The equation of the line is

$$y = 6.9 + 0.27t$$

where y is the weight and t is the age in months. What is the slope of the least squares line?

- (a) 6.9
- (b) .27
- (c) 9.3
- (d) 6.63
- (e) NOTA

10. You have measured the systolic blood pressure of a random sample of 25 employees of a company located near you. A 95% confidence interval for the mean systolic blood pressure for the employees of this company is (122, 138). Which of the following statements gives a valid interpretation of this interval?

- (a) 95% of the sample of employees have a systolic blood pressure between 122 and 138
- (b) 95% of the population of employees have a systolic blood pressure between 122 and 138
- (c) If the procedure were repeated many times, 95% of the resulting confidence intervals would contain the population mean systolic blood pressure.
- (d) If the procedure were repeated many times, 95% of the sample means would be between 122 and 138.
- (e) NOTA

11. You notice that your car seems to run better when you use Brand A gasoline than when you use Brand B. Can you conclude that Brand A is better than Brand B for your car?

- (a) Yes. This is a simple random sample.
- (b) No. the evidence is anecdotal
- (c) Yes. This is a comparative experiment
- (d) No. The two brands are the same
- (e) NOTA

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12. A student organization wants to assess the attitudes toward a proposed change in the hours that the library is open. They randomly select 50 freshmen, 50 sophomores, 50 juniors, and 50 seniors. The situation described is

- (a) simple random sample
- (b) a comparative experiment
- (c) anecdotal evidence
- (d) a stratified random sample
- (e) NOTA

13. The distribution of the population by religion in a village near the Indian city of Cochin is as follows:

Hindu	50%
Moslem	30%
Christian	10%
Jewish	5%
Others	5%

What is the probability that a randomly chosen person is neither Christian nor Jewish?

- (a) .80
- (b) .55
- (c) .15
- (d) .90
- (e) NOTA

14. The following table gives the probability distribution of causes of death in the U.S.

Cause	Probability
cardiovascular disease	.47
malignancies	.22
accidents	*
chronic pulmonary disease	.04
pneumonia and influenza	.03
diabetes mellitus	.02
suicide	.01
all other causes	.16

What must be the probability that a randomly chosen death was due to an accident in order for this to be a legitimate probability distribution?

- (a) .50
- (b) .05
- (c) .15
- (d) .35
- (e) NOTA

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15. A certain trait is inherited by 75% of the offspring of a particular cross in an animal breeding program. Inheritance of this trait by different offspring is independent. In a litter of three offspring, what is the probability that none of the offspring have this trait?

- (a) .9844
- (b) .7500
- (c) .2500
- (d) .0156
- (e) NOTA

16. A study of health care recorded the number of visits X to physician made by a person in a year. Here is the probability distribution of the random variable X .

Visits	0	1	2	3	4	5	6	7	8	9	10	11	12
Probability	.10	.08	.06	.08	.12	.13	.12	.10	.09	.06	.03	.02	.01

What is the mean number of physician visits made by a person in a year?

- (a) 4.37
- (b) 5.91
- (c) 4.89
- (d) 2.64
- (e) NOTA

17. In a population of students, the number of calculators owned is a random variable X with $P(X = 0) = .2$, $P(X = 1) = .6$, and $P(X = 2) = .2$. The mean of this probability distribution is

- (a) 1
- (b) 0
- (c) 2
- (d) .5
- (e) NOTA

18. An athlete suspected of having used steroids is given two tests that operate independently of each other. Test A has probability 0.9 of being positive if steroids have been used. Test B has probability 0.8 of being positive if steroids have been used. What is the probability that *neither* test is positive if steroids have been used?

- (a) 0.80
- (b) 0.90
- (c) 0.72
- (d) 0.28
- (e) NOTA

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19. An instant lottery game gives you probability of 0.02 of winning on any one play. Plays are independent of each other. If you play 5 times, what is the probability that you win at least once?

- (a) 0.0961
- (b) 0.0922
- (c) 0.9039
- (d) 0.1000
- (e) NOTA

20. The probability of rolling a 5 when tossing two balanced dice is $1/9$. If you roll three times, what is the probability of three consecutive 5s?

- (a) 0.0300
- (b) 0.0500
- (c) 0.0014
- (d) 0.0035
- (e) NOTA

21. About 9% of the residents of Indiana are black. You choose Indiana residents at random (independently of each other) for an opinion poll. You choose 450 people in all. What is the mean number of blacks among the people chosen?

- (a) 38.29
- (b) 87.34
- (c) 36.85
- (d) 45.56
- (e) NOTA

22. In exercise 21 above, what is the standard deviation of the number of blacks among the people chosen?

- (a) 4.09
- (b) 6.83
- (c) 5.54
- (d) 6.07
- (e) NOTA

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23. An African hospital is treating patients who have Lhasa Fever. Seventy percent of patients with this disease die, and each patient lives or dies independently of other patients. There are currently 12 Lhasa Fever patients in the hospital. Find the probability that 6 or fewer (no more than half the patients) die.

- (a) 0.0792
- (b) 0.4375
- (c) 0.9072
- (d) 0.1658
- (e) NOTA

24. In a large population of college students, 20% of the students have experienced feelings of math anxiety. If you take a random sample of 10 students from this population, the probability that exactly 2 students have experienced math anxiety is

- (a) .5000
- (b) .3020
- (c) .2634
- (d) .2013
- (e) NOTA

25. Leakage from underground gasoline tanks at service stations is a current environmental concern. It is estimated that 25% of these tanks leak. You do a large study, examining random sample of 1000 tanks nationally. What is the probability that at least 275 of these tanks are leaking?

- (a) .0572
- (b) .0490
- (c) .4008
- (d) .0336
- (e) NOTA

26. Cholesterol level in a particular male population is assumed to follow a normal distribution with standard deviation of 32 units. You want to estimate the population mean cholesterol level within ± 10 units with 95% confidence. How large a sample must you take?

- (a) 200
- (b) 40
- (c) 80
- (d) 150
- (e) NOTA

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27. You want to compute a 95% confidence interval for a population mean. Assume that the population standard deviation is known to be 10 and the sample size is 50. The value of z^* to be used in this calculation is

- (a) 1.645
- (b) 2.009
- (c) 1.960
- (d) 2.330
- (e) NOTA

28. A significance test gives a P-value of 0.04. From this we can

- (a) reject H_0 with $\alpha = .01$
- (b) reject H_0 with $\alpha = .05$
- (c) say that the probability that H_0 is false is .04
- (d) say that the probability that H_0 is true is .04
- (e) NOTA

29. A 95% confidence interval for the mean reading achievement score for a population of third grade students is (44.2, 54.2). The sample mean is

- (a) 44.2
- (b) 54.2
- (c) .95
- (d) 49.2
- (e) NOTA

30. You read in a journal a report of a study that found a statistically significant result at the 5% significance level. What can you say about the significance of this result at the 1% level?

- (a) it is certainly not significant at the 1% level
- (b) it may or may not be significant at the 1% level
- (c) it certainly is significant at the 1% level
- (d) it would be significant at any level
- (e) NOTA