一、（50%）

1. Table 1 shows the annual incidence rates for colon cancer, lung cancer, and stomach cancer in males ages 50 years and older from the Connecticut Tumor Registry.

   a. (7%) What is the probability that a 55-year-old, disease-free male will develop colon cancer over the next 5 years?

   b. (8%) Suppose there is a cohort of 1000 50-year-old men who have never had cancer. How many colon cancers would be expected to develop in this cohort over a 15-year period?

Table 1

Average annual incidence per 100,000 males for colon, lung, and stomach cancer from the Connecticut Tumor Registry 1963–1965

Type of cancer	Ages 50–54	55–59	60–64
Colon	35.7	60.3	98.9
Lung	76.1	137.5	231.7
Stomach	20.8	39.1	46.0

2. An outbreak of acute gastroenteritis occurred at a nursing home in Baltimore, Maryland, in December 1980. A total of 46 out of 98 residents of the nursing home became ill. People living in the nursing home shared rooms: 13 rooms contained 2 occupants, 4 rooms contained 3 occupants, and 15 rooms contained 4 occupants. One question that arises is whether or not a geographical clustering of disease occurred for persons living in the same room. A summary of the number of affected people and the total number of people in a room is given in Table 2.

   a. (7%) If the binomial distribution holds, what is the probability distribution of the number of affected people in rooms with 2 occupants? That is, what is the probability of finding zero affected people? One affected person? Two affected people?

   b. (10%) One useful summary measure of geographical clustering is the number of rooms with 2 or more affected occupants. If the binomial distribution holds, what is the expected number of rooms with 2 or more affected occupants over the entire nursing home?

   c. (3%) Compare the observed number of rooms with 2 or more affected occupants with the expected number of rooms. Does this comparison give any evidence that clustering of disease occurs within rooms?

Table 2

Number of affected people and total number of people in a room for an outbreak of acute gastroenteritis in a nursing home in Baltimore, Maryland

People in room	Total number of rooms	Number of rooms with				
		0 affected people	1 affected person	2 affected people	3 affected people	4 affected people
2	13	5	4	4	0	0
3	4	1	2	0	1	0
4	15	2	4	3	5	1

3. Given λ, a fixed positive constant, define the following function:

$$f(x) = \frac{1}{2}\lambda e^{-\lambda x}, \text{ for } x \geq 0; \quad f(x) = \frac{1}{2}\lambda e^{\lambda x}, \text{ for } x < 0 \text{。}$$

   a. (10%) If the probability density function of the random variable X is f(x), find P(X<t) for all possible values of t.

   b. (5%) For all possible values of t, find P(|X| < t).

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二、(50%) Use significant level .05 unless otherwise specified.

1. The students' statistics scores of a college of business are normally distributed with a mean 70 points and a standard deviation 9 points.

   a. (5%) If 9 students are taken as a simple random sample, what is the probability that the mean score will be between 67 and 71.5 points?
   b. (5%) How many students must be selected so that the margin of error for the 95% confidence interval of the mean score is within 5 points?

2. Data were collected on 39 seventh-grade students in a Midwest school to determine what factors are related to their academic performance score (AP score). The explanatory variables are IQ (score on an IQ test), SC (overall score on the Piers-Harris Children's Self-Concept Scale), and SEX (1 for male and 0 for female). A multiple regression is conducted and the results are as follows:

ANOVA table			Regression Results		
			Variable	Estimate	Standard error
	df	SS	Intercept	0.56551	1.82882
Regression		83.81322	IQ	0.04845	0.01658
Error			SC	0.03696	0.01741
Total		125.24930	SEX	-1.08573	0.47978

   a. (5%) For a male student with IQ 100 and SC score 50 and his AP score is 4. What is the residual?
   b. (5%) Conduct a test to determine if IQ score is an important predictor for AP score.
   c. (5%) With confidence coefficient .95, how does AP score change for one unit increases in IQ score while holding SC score and SEX constant?
   d. (5%) What is the test statistics (numerical value) for testing if NONE of the predictors are significant?

3. Are men more willing to spend money on luxury cars than women? A survey took 100 men and 100 women as random sample, it was found that 30 men and 10 women were willing to spend money for luxury cars.

   a. (5%) Conduct a test to determine if men are more willing to spend money on luxury cars than women.
   b. (5%) Construct a 95% confidence interval for difference in population proportions between men and women who are willing to spend money on luxury cars.

4. Young Adult magazine states the hypotheses about the mean age of its subscribers.

   Ho: $\mu = 28$

   Ha: $\mu \neq 28$

   a. (5%) The population standard deviation is assumed known 6 years and the sample size is 100. With a significant level .05, what is the probability of NOT rejecting Ho for μ equal to 26?
   b. (5%) What is the power at $\mu = 26$?

Cumulative probability for z is the area under the standard normal curve to the left of z

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

t Distribution Critical Values Right tail probability

			Right-Tail Probability			
df	$t_{.100}$	$t_{.050}$	$t_{.025}$	$t_{.010}$	$t_{.005}$	$t_{.001}$
1	3.078	6.314	12.706	31.821	63.656	318.289
2	1.886	2.920	4.303	6.965	9.925	22.328
3	1.638	2.353	3.182	4.541	5.841	10.214
4	1.533	2.132	2.776	3.747	4.604	7.173
5	1.476	2.015	2.571	3.365	4.032	5.894
6	1.440	1.943	2.447	3.143	3.707	5.208
7	1.415	1.895	2.365	2.998	3.499	4.785
8	1.397	1.860	2.306	2.896	3.355	4.501
9	1.383	1.833	2.262	2.821	3.250	4.297
10	1.372	1.812	2.228	2.764	3.169	4.144
11	1.363	1.796	2.201	2.718	3.106	4.025
12	1.356	1.782	2.179	2.681	3.055	3.930
13	1.350	1.771	2.160	2.650	3.012	3.852
14	1.345	1.761	2.145	2.624	2.977	3.787
15	1.341	1.753	2.131	2.602	2.947	3.733
16	1.337	1.746	2.120	2.583	2.921	3.686
17	1.333	1.740	2.110	2.567	2.898	3.646
18	1.330	1.734	2.101	2.552	2.878	3.611
19	1.328	1.729	2.093	2.539	2.861	3.579
20	1.325	1.725	2.086	2.528	2.845	3.552
21	1.323	1.721	2.080	2.518	2.831	3.527
22	1.321	1.717	2.074	2.508	2.819	3.505
23	1.319	1.714	2.069	2.500	2.807	3.485
24	1.318	1.711	2.064	2.492	2.797	3.467
25	1.316	1.708	2.060	2.485	2.787	3.450
26	1.315	1.706	2.056	2.479	2.779	3.435
27	1.314	1.703	2.052	2.473	2.771	3.421
28	1.313	1.701	2.048	2.467	2.763	3.408
29	1.311	1.699	2.045	2.462	2.756	3.396
30	1.310	1.697	2.042	2.457	2.750	3.385
40	1.303	1.684	2.021	2.423	2.704	3.307
50	1.299	1.676	2.009	2.403	2.678	3.261
60	1.296	1.671	2.000	2.390	2.660	3.232
80	1.292	1.664	1.990	2.374	2.639	3.195
100	1.290	1.660	1.984	2.364	2.626	3.174
∞	1.282	1.645	1.960	2.326	2.576	3.091

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