

考 試 科 目	統計方法	系 所 別	統計學系	考 試 時 間	乙 月 12 日(三) 第 4 節
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- (10%) Suppose you are taking a multiple-choice test with m choices for each question. In answering a question on this test, the probability that you know the answer is p . If you don't know the answer, you choose one at random. What is the probability that you knew the answer to a question, given that you answered it correctly?
- (15%) Suppose that buses arrive are scheduled to arrive at a bus stop at 8:00 but are always Y minutes late, where Y is an exponential random variable with parameter θ . Suppose that you arrive at the bus stop precisely at 8:00. (Note: $e^1 = 2.718$)
 - If you have already waiting for five minutes, compute the probability that you have to wait an additional five minutes or more. (7%)
 - Compute the median for the parameter θ of the exponential distribution. (8%)
- (25%) You independently draw 23 data points from a normal distribution. The 23 data points have sample mean 4.1 and sample variance 4.
 - Please conduct a test with the null hypothesis $H_0: \mu=3.2$ against the alternative hypothesis $H_1: \mu \neq 3.2$ at a significance level of $\alpha = 0.05$. (8%)
 - What is the p -value for part (a)? (7%)
 - Determine the probability of committing the test using the alternative $H_1: \mu=3.3$. (10%)
- (20%) A survey is conducted to examine the relationship between gender (male and female) and preference for three different brands (A, B, and C). The observed frequencies are shown as follows:

	Brand A	Brand B	Brand C
Male	30	50	25
Female	40	40	30

Answer the following questions at the 0.01 significance level.

- If p_A and p_C indicate the population proportions of male persons who prefer brands A and C, respectively, then conduct a test to decide where p_A and p_C are equal or not. (10%)
- Conduct a test for independence between gender and brand preference. (10%)

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5. (30%) The grades of a class of 10 students on a midterm report (explanatory variable, X) and on the final examination (response variable, Y) are shown below:

Midterm (X)	77	55	70	73	83	92	94	93	85	68
Final (Y)	82	67	78	56	69	87	97	95	90	65

We also have obtained $\sum X_i = 790$, $\sum X_i^2 = 63870$, $\sum Y_i = 786$, $\sum Y_i^2 = 63522$, and $\sum X_i Y_i = 63301$. Below shows part of the estimation result based on these data.

	Coefficient	Standard error	T
Intercept	(A)	20.18	(C)
Midterm	(B)	0.25	(D)

- (a) Compute the values (A) to (D) in details, and conclude whether the slope of the linear regression model is significantly different from zero at the 0.01 significance level. (10%)
- (b) If we fit the regression model without the intercept term for these data, then find the estimate of the slope. (5%)
- (c) If another explanatory variable, gender, is included in the analysis, then we obtain the following analysis of variance:

	Degree of freedom	SS	MS	F
Regression	(E)	(H)	(K)	(L)
Error	(F)	(I)	90.07	
Total	(G)	(J)		

Please compute the values (E) to (L) in details, and specify the required formulas. (10%)

- (d) Please show whether gender is a significant variable, given X is already in the model using $\alpha = 0.05$. (5%)

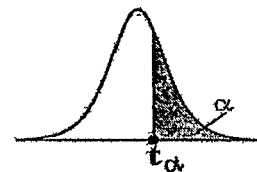
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- 一、作答於試題上者，不予計分。
二、試題請隨卷繳交。

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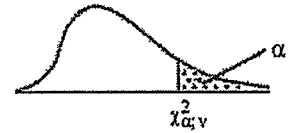
Percentage Points of the t Distribution; $t_{v,\alpha}$
 $P(T > t_{v,\alpha}) = \alpha$



v	α													
	0.40	0.30	0.20	0.15	0.10	0.05	0.025	0.02	0.015	0.01	0.0075	0.005	0.0025	0.0005
1	0.325	0.727	1.376	1.963	3.078	6.314	12.706	15.895	21.205	31.821	42.434	63.657	127.322	636.590
2	0.289	0.617	1.061	1.386	1.886	2.920	4.303	4.849	5.643	6.965	8.073	9.925	14.089	31.598
3	0.277	0.584	0.978	1.250	1.638	2.353	3.182	3.482	3.896	4.541	5.047	5.841	7.453	12.924
4	0.271	0.569	0.941	1.190	1.533	2.132	2.776	2.999	3.298	3.747	4.088	4.604	5.598	8.610
5	0.267	0.559	0.920	1.156	1.476	2.015	2.571	2.757	3.003	3.365	3.634	4.032	4.773	6.869
6	0.265	0.553	0.906	1.134	1.440	1.943	2.447	2.612	2.829	3.143	3.372	3.707	4.317	5.959
7	0.263	0.549	0.896	1.119	1.413	1.895	2.365	2.517	2.715	2.998	3.203	3.499	4.029	5.408
8	0.262	0.546	0.889	1.108	1.397	1.860	2.306	2.449	2.634	2.896	3.085	3.355	3.833	5.041
9	0.261	0.543	0.883	1.100	1.383	1.833	2.262	2.398	2.574	2.821	2.998	3.250	3.690	4.781
10	0.260	0.542	0.879	1.093	1.372	1.812	2.228	2.359	2.527	2.764	2.932	3.169	3.581	4.587
11	0.260	0.540	0.876	1.088	1.363	1.796	2.201	2.328	2.491	2.718	2.879	3.106	3.497	4.437
12	0.259	0.539	0.873	1.083	1.356	1.782	2.179	2.303	2.461	2.681	2.836	3.055	3.428	4.318
13	0.259	0.538	0.870	1.079	1.350	1.771	2.160	2.282	2.436	2.650	2.801	3.012	3.372	4.221
14	0.258	0.537	0.868	1.076	1.343	1.761	2.145	2.264	2.415	2.624	2.771	2.977	3.326	4.140
15	0.258	0.536	0.866	1.074	1.341	1.753	2.131	2.249	2.397	2.602	2.746	2.947	3.286	4.073
16	0.258	0.535	0.865	1.071	1.337	1.746	2.120	2.235	2.382	2.583	2.724	2.921	3.252	4.015
17	0.257	0.534	0.863	1.069	1.333	1.740	2.110	2.224	2.368	2.567	2.706	2.898	3.222	3.965
18	0.257	0.534	0.862	1.067	1.330	1.734	2.101	2.214	2.356	2.552	2.689	2.878	3.197	3.922
19	0.257	0.533	0.861	1.066	1.328	1.729	2.093	2.205	2.346	2.539	2.674	2.861	3.174	3.883
20	0.257	0.533	0.860	1.064	1.325	1.725	2.086	2.197	2.338	2.528	2.661	2.845	3.153	3.850
21	0.257	0.532	0.859	1.063	1.323	1.721	2.080	2.189	2.328	2.518	2.649	2.831	3.135	3.819
22	0.256	0.532	0.858	1.061	1.321	1.717	2.074	2.183	2.320	2.508	2.639	2.819	3.119	3.792
23	0.256	0.532	0.858	1.060	1.319	1.714	2.069	2.177	2.313	2.500	2.629	2.807	3.104	3.768
24	0.256	0.531	0.857	1.059	1.318	1.711	2.064	2.172	2.307	2.492	2.620	2.797	3.091	3.745
25	0.256	0.531	0.856	1.058	1.316	1.708	2.060	2.167	2.301	2.485	2.612	2.787	3.078	3.725
26	0.256	0.531	0.856	1.058	1.315	1.706	2.056	2.162	2.296	2.479	2.605	2.779	3.067	3.707
27	0.256	0.531	0.855	1.057	1.314	1.703	2.052	2.158	2.291	2.473	2.598	2.771	3.057	3.690
28	0.256	0.530	0.855	1.056	1.313	1.701	2.048	2.154	2.286	2.467	2.592	2.763	3.047	3.674
29	0.256	0.530	0.854	1.055	1.311	1.699	2.045	2.150	2.282	2.462	2.586	2.756	3.038	3.659
30	0.256	0.530	0.854	1.055	1.310	1.697	2.042	2.147	2.278	2.457	2.581	2.750	3.030	3.646
40	0.255	0.529	0.851	1.050	1.303	1.684	2.021	2.123	2.250	2.423	2.542	2.704	2.971	3.551
60	0.254	0.527	0.848	1.045	1.296	1.671	2.000	2.099	2.223	2.390	2.504	2.660	2.915	3.460
120	0.254	0.526	0.845	1.041	1.289	1.658	1.980	2.076	2.196	2.358	2.468	2.617	2.860	3.373
∞	0.253	0.524	0.842	1.036	1.282	1.645	1.960	2.054	2.170	2.326	2.432	2.576	2.807	3.291

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Table of the Chi-square Distribution



$\alpha =$	0.995	0.99	0.98	0.975	0.95	0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	0.05	0.025	0.02	0.01	0.005	0.001	$=\alpha$
$v = 1$	0.0000393	0.000157	0.000628	0.000982	0.00393	0.0158	0.0642	0.1642	0.2706	0.3841	0.5024	0.5412	0.635	0.7879	10.827	13.815	16.268	18.465	20.517		$v = 1$
2	0.0100	0.0201	0.0404	0.0506	0.103	0.211	0.446	0.719	0.905	1.065	1.238	1.378	1.538	1.676	1.848	2.000	2.179	2.338	2.538	2.700	2
3	0.0717	0.115	0.185	0.216	0.352	0.584	1.005	1.464	1.751	2.071	2.366	2.602	2.847	3.075	3.348	3.565	3.793	4.101	4.347	4.608	3
4	0.207	0.297	0.429	0.484	0.711	1.064	1.649	2.204	2.558	2.955	3.326	3.642	3.935	4.215	4.571	4.878	5.191	5.591	5.989	6.377	4
5	0.412	0.554	0.752	0.831	1.145	1.610	2.343	2.889	3.326	3.778	4.255	4.638	4.935	5.226	5.608	5.964	6.256	6.708	7.042	7.378	5
6	0.676	0.872	1.134	1.237	1.635	2.204	3.070	3.558	4.001	4.451	4.935	5.318	5.615	5.908	6.291	6.651	6.933	7.378	7.691	8.033	6
7	0.989	1.239	1.564	1.690	2.167	2.833	3.822	4.303	4.751	5.201	5.676	6.059	6.356	6.648	7.031	7.381	7.653	8.183	8.455	8.797	7
8	1.344	1.646	2.032	2.180	2.733	3.490	4.594	5.075	5.523	5.973	6.448	6.831	7.128	7.420	7.803	8.153	8.425	9.025	9.297	9.639	8
9	1.735	2.088	2.532	2.700	3.325	4.168	5.380	5.861	6.309	6.759	7.234	7.617	7.914	8.206	8.589	8.939	9.211	9.841	10.113	10.455	9
10	2.156	2.558	3.059	3.247	3.940	4.865	6.179	6.660	7.108	7.558	8.033	8.416	8.713	9.005	9.388	9.738	10.010	10.680	10.952	11.294	10
11	2.603	3.053	3.609	3.816	4.575	5.578	6.989	7.470	7.918	8.368	8.843	9.226	9.523	9.815	10.198	10.548	10.820	11.530	11.802	12.144	11
12	3.074	3.571	4.178	4.404	5.226	6.304	7.807	8.288	8.736	9.186	9.661	10.044	10.341	10.633	11.016	11.366	11.638	12.378	12.650	13.002	12
13	3.565	4.107	4.765	5.009	5.892	7.042	8.634	9.115	9.563	10.013	10.488	10.871	11.168	11.460	11.843	12.193	12.465	13.235	13.507	13.869	13
14	4.075	4.660	5.368	5.629	6.571	7.790	9.467	9.948	10.396	10.846	11.321	11.704	12.001	12.293	12.676	13.026	13.298	14.088	14.360	14.722	14
15	4.601	5.229	5.985	6.262	7.261	8.547	10.307	10.788	11.236	11.686	12.161	12.544	12.841	13.133	13.516	13.866	14.138	14.948	15.220	15.582	15

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Table of Probabilities for the F Distribution

Alpha = 0.05

D/N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	20	24	30	40	60	120
1	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54	241.88	242.98	243.91	244.69	245.36	245.95	248.01	249.05	250.10	251.14	252.20	253.25
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.40	19.41	19.42	19.42	19.43	19.45	19.45	19.46	19.47	19.48	19.49
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.76	8.74	8.73	8.71	8.70	8.66	8.64	8.62	8.59	8.57	8.55
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.94	5.91	5.89	5.87	5.86	5.80	5.77	5.75	5.72	5.69	5.66
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.70	4.68	4.66	4.64	4.62	4.56	4.53	4.50	4.46	4.43	4.40
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.03	4.00	3.98	3.96	3.94	3.87	3.84	3.81	3.77	3.74	3.70
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.60	3.57	3.55	3.53	3.51	3.44	3.41	3.38	3.34	3.30	3.27
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.31	3.28	3.26	3.24	3.22	3.15	3.12	3.08	3.04	3.01	2.97
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.10	3.07	3.05	3.03	3.01	2.94	2.90	2.86	2.83	2.79	2.75
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.94	2.91	2.89	2.86	2.85	2.77	2.74	2.70	2.66	2.62	2.58
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.82	2.79	2.76	2.74	2.72	2.65	2.61	2.57	2.53	2.49	2.45
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.72	2.69	2.66	2.64	2.62	2.54	2.51	2.47	2.43	2.38	2.34
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.63	2.60	2.58	2.55	2.53	2.46	2.42	2.38	2.34	2.30	2.25
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.57	2.53	2.51	2.48	2.46	2.39	2.35	2.31	2.27	2.22	2.18
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.51	2.48	2.45	2.42	2.40	2.33	2.29	2.25	2.20	2.16	2.11
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.46	2.42	2.40	2.37	2.35	2.28	2.24	2.19	2.15	2.11	2.06
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.41	2.38	2.35	2.33	2.31	2.23	2.19	2.15	2.10	2.06	2.01
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.37	2.34	2.31	2.29	2.27	2.19	2.15	2.11	2.06	2.02	1.97
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.34	2.31	2.28	2.26	2.23	2.16	2.11	2.07	2.03	1.98	1.93
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.31	2.28	2.25	2.22	2.20	2.12	2.08	2.04	1.99	1.95	1.90
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.28	2.25	2.22	2.20	2.18	2.10	2.05	2.01	1.96	1.92	1.87
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.26	2.23	2.20	2.17	2.15	2.07	2.03	1.98	1.94	1.89	1.84
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.24	2.20	2.18	2.15	2.13	2.05	2.01	1.96	1.91	1.86	1.81
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.22	2.18	2.15	2.13	2.11	2.03	1.98	1.94	1.89	1.84	1.79
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.20	2.16	2.14	2.11	2.09	2.01	1.96	1.92	1.87	1.82	1.77
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.18	2.15	2.12	2.09	2.07	1.99	1.95	1.90	1.85	1.80	1.75
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.17	2.13	2.10	2.08	2.06	1.97	1.93	1.88	1.84	1.79	1.73
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.15	2.12	2.09	2.06	2.04	1.96	1.91	1.87	1.82	1.77	1.71
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18	2.14	2.10	2.08	2.05	2.03	1.94	1.90	1.85	1.81	1.75	1.70
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.13	2.09	2.06	2.04	2.01	1.93	1.89	1.84	1.79	1.74	1.68
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.04	2.00	1.97	1.95	1.92	1.84	1.79	1.74	1.69	1.64	1.58
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.95	1.92	1.89	1.86	1.84	1.75	1.70	1.65	1.59	1.53	1.47
120	3.92	3.07	2.68	2.45	2.29	2.18	2.09	2.02	1.96	1.91	1.87	1.83	1.80	1.78	1.75	1.66	1.61	1.55	1.50	1.43	1.35

Right Tailed, D/N = df in denominator = down the rows, df in numerator = across the columns

Note: Table is for an alpha of 0.05

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- 一、作答於試題上者，不予計分。
- 二、試題請隨卷繳交。