

(10分) 一. 是非題: 以 "T" 表 "是", "F" 表 "非", 每小題 1 分

1. 無論是間斷型 (Discrete) 或連續型 (Continuous) 之隨機變數 (Random Variables) 都有一共通之特性, 即求取區間 (Interval) 之機率時可以不用考慮其端點 (End Point).
2. 一隨機樣本數為 n 之平均數為一隨機變數。
3. 若已知兩隨機變數 X_1 與 X_2 為彼此獨立, 則期望值 $E(X_1 X_2) = E(X_1) E(X_2)$; 反之, 若期望值 $E(X_1 X_2) = E(X_1) E(X_2)$ 則亦可斷定 X_1 與 X_2 為彼此獨立。
4. 兩隨機變數 X_1 與 X_2 之相關係數 (Correlation Coefficient) 為 $\rho_{X_1, X_2} = \frac{\text{Cov}(X_1, X_2)}{\sigma_{X_1} \sigma_{X_2}}$, 則當該係數為 0 所代表之意義即兩隨機變數彼此相依 (Dependent).
5. 中位數 (Median) 之計算因受極端數值之影響, 故自群體中所取之樣本, 其樣本中位數之變化範圍較平均數之變化為大。
6. 常態分配 (Normal Distribution) 之反曲點 (Inflection) 位於 $\mu \pm \sigma$ 之處。
7. 若群體之分配為未知, 而抽取之樣本數 n 甚大, 則依中央極限原理 (Central Limit Theorem) 可視為近似常態分配, 具平均數 μ 及變異數 (Variance) $\frac{\sigma^2}{n}$ 。
8. 可信賴區間 (Confidence Interval) 之幅度可以藉增加樣本數目或減低有意義水準 (Level of Significance α 值) 以降低之。
9. 隨機變數 $(n-1)S^2/\sigma^2$ 為具 $n-1$ 個自由度 (Degrees of Freedom) 之卡方分配 (Chi-Square Distribution)。
10. 二次分配 (Binomial Distribution) 與超幾何分配 (Hypergeometric Distribution) 之差異僅在於抽樣時是否具取放 (Replacement) 之特性。

(5分) 二. 給予以下之隨機變數, 試指出自隨機變數計算所得各隨機變數係屬何種分配. 每小題1分.

$$X_i \sim N(\mu, \sigma^2), i=1, 2, \dots, n; W_i \sim N(0, 1), i=1, 2, \dots, m;$$

$$Y \sim X_m^2; V \sim X_n^2$$

1. $(X_i - \mu) / \sigma$

2. $\sum_{i=1}^n (X_i - \bar{X})^2 / \sigma^2$

3. $\sum_{i=1}^m W_i^2$

4. $W / \sqrt{Y/m}$

5. $\frac{Y/m}{V/n}$

三. 某一個電子裝置包含兩構件. 每一構件使用至故障之時間長度(以小時計)為一隨機變數而分別以 Y_1 及 Y_2 表之. 若已知 Y_1 及 Y_2 之聯合分配函數為 $F_{Y_1, Y_2}(a, b) = 1 - e^{-0.01a} - e^{-0.01b} + e^{-0.01(a+b)}$ $a \geq 0, b \geq 0$

(4分) (a) 試問 Y_1 與 Y_2 是否為獨立? (須列出所有計算過程始給分)

(4分) (b) 試問每一個構件之壽命期均大於或等於 100 小時之機率為多少?

(5分) 四. 設 2000 位學生的身高接近常態分配 (Normal Distribution) 具平均數 170.5 公分及標準偏差 7.3 公分. 若 200 位隨機樣本中之 25 位被抽取自群體且平均數計算至古幼之有效精準, 試求樣本平均數落於 169 公分及 172 公分間之數目有多少位?

(5分) 五. 設自一具平均數 10, 變異數 4 之常態分配群體中隨機抽取 9 個樣本, 其樣本值分別為 $X_1, X_2, X_3, \dots, X_9$, 今又獨立自另一具平均數 20, 變異數 9 之常態分配群體中隨機抽取 16 個樣本, 其樣本值分別為 $Y_1, Y_2, Y_3, \dots, Y_{16}$, 令 \bar{X}, \bar{Y}, S_x^2 及 S_y^2 分別為各樣本之平均數與變異數. 試求 $P[(\bar{X} - \bar{Y}) \geq -9]$ 之機率?

(5分) 六. 設 10 件物品隨機自生產成品中抽取, 其計測之量值(精準至 0.01 單位) 分別為 3.79, 3.66, 3.82, 4.21, 3.97, 4.15, 4.04, 4.25, 3.86, 4.10, 試求 90% 平均量值之可信賴區間? (假設群體為常態)

(6分) 七. 某冷氣製造公司聲稱他的品牌 A 銷售量較另一冷氣公司品牌 B 的銷售量多至少 10%, 若抽樣顯示 200 位抽樣者中有 60 位喜歡品牌 A, 而 150 位抽樣者中有 27 位喜歡品牌 B, 試問其 10% 的差異聲稱是否合理? 利用 $\alpha = 0.05$ 檢定之.

國立成功大學八十學年度工業設計研究所考試(統計學 試題)共4頁 第3頁

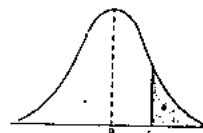
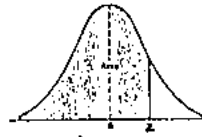
(6分)八. 某汽車油品公司聲稱其新發展之汽油催化劑至少可以使汽車每公升汽油多跑1哩,今抽取10種品牌之汽車作試驗,其資料為

汽車品牌	A	B	C	D	E	F	G	H	I	J
汽車未添加該催化劑每公升之公里數	14.4	10.5	9.3	8.5	10.3	11.5	10.8	12.1	9.8	8.7
汽車添加該催化劑每公升之公里數	13.9	13.4	10.8	10.3	9.6	13.7	12.8	11.5	12.1	8.6

試以 $\alpha=0.05$ 檢定該公司之聲稱。(假設每公升汽油所跑里程數為常態分配)

Areas Under the Normal Curve

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	.9278	.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



Critical Values of the t Distribution

v	α				
	0.10	0.05	0.025	0.01	0.005
1	3.078	6.314	12.706	31.821	63.657
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.132	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
9	1.383	1.833	2.262	2.821	3.250
10	1.372	1.812	2.228	2.764	3.169
11	1.363	1.796	2.201	2.718	3.106
12	1.356	1.782	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.898
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.708	2.060	2.485	2.787
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
inf.	1.282	1.645	1.960	2.326	2.576

九. 假若麵包店每天售出蛋糕數為一隨機變數 X 之機率分配為

$$f(x) = \frac{1}{6} \quad X = 0, 1, 2, 3, 4, 5$$

每賣出一盒蛋糕獲利 \$100 元, 否則損失 \$40 元

假若蛋糕祇能當天出售. 求其當天作四盒蛋糕的期望利潤. (8%)

十. 某產品平均不良率為 2% 試求 400 個產品中有 5 個產品不良的機率. 列出你可以採用兩種計算公式. (8%)

十一. 某汽車公司針對棗紅色, 深藍色, 銀灰色三種顏色對男女消費者進行調查結果如下:

	棗紅	深藍	銀灰
男	47	59	56
女	33	61	44

根據以上資料, 試以 $\alpha = 0.05$ 顯著水準, 檢定男女對汽車顏色是否有不同偏好. (10%)

十二. 下列資料為十名少女試用減肥菜單, 其減肥前後之體重(磅)如下:

	1	2	3	4	5	6	7	8	9	10
減肥前	134	147	165	152	122	138	147	153	178	137
減肥後	131	140	164	153	122	135	148	147	165	133

(1) 假定減肥前後體重之分配近於常態 = 者變異數相等, 試以 $\alpha = 0.01$ 顯著水準檢定減肥菜單是否有效? (8%)

(2) 分析本題, 除去你所選之方法, 你尚可以採用何種方法? 試略加說明? 並說明你在 (1) 中不採用該法之理由. (6%)

十三. 迴歸分析中 $Y_i = a + bX_i + \epsilon_i$ 其中 ϵ_i 所代表的意義為何? ϵ_i 並有那些假設條件, 請予以條列出. (10%)

工設所 統計學 附表 6-1

工設所 統計學 附表 6-2

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 $0.499999999.$

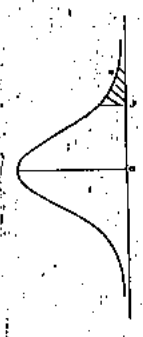


The entries in Table I are the probabilities that a random variable having the standard normal distribution will take on a value between 0 and z ; they are given by the area of the white region under the curve in the figure shown above.

TABLE II Values of t'

$d.f.$	$t_{.99}$	$t_{.95}$	$t_{.90}$	$t_{.85}$	$t_{.80}$	$t_{.75}$	$t_{.70}$	$t_{.65}$	$t_{.60}$	$d.f.$
1	3.078	6.314	12.706	31.821	63.657					1
2	1.886	2.920	4.303	6.965	9.925					2
3	1.508	2.353	3.182	4.541	5.841					3
4	1.533	2.132	2.776	3.747	4.604					4
5	1.476	2.015	2.571	3.365	4.032					5
6	1.440	1.943	2.447	3.143	3.707					6
7	1.415	1.895	2.365	2.998	3.499					7
8	1.397	1.860	2.306	2.896	3.353					8
9	1.385	1.833	2.282	2.821	3.250					9
10	1.372	1.812	2.228	2.754	3.169					10
11	1.363	1.796	2.201	2.716	3.106					11
12	1.356	1.782	2.179	2.681	3.055					12
13	1.350	1.771	2.163	2.650	3.012					13
14	1.345	1.761	2.148	2.624	2.977					14
15	1.341	1.753	2.135	2.602	2.947					15
16	1.337	1.746	2.120	2.583	2.921					16
17	1.333	1.740	2.110	2.567	2.898					17
18	1.330	1.734	2.101	2.552	2.878					18
19	1.326	1.729	2.093	2.539	2.861					19
20	1.325	1.725	2.086	2.528	2.845					20
21	1.323	1.721	2.080	2.518	2.831					21
22	1.321	1.717	2.074	2.508	2.819					22
23	1.319	1.714	2.069	2.500	2.807					23
24	1.318	1.711	2.064	2.492	2.797					24
25	1.316	1.708	2.060	2.485	2.787					25
26	1.315	1.706	2.058	2.479	2.779					26
27	1.314	1.703	2.052	2.472	2.771					27
28	1.313	1.701	2.048	2.467	2.763					28
29	1.311	1.699	2.045	2.462	2.756					29
30	1.311	1.695	2.045	2.462	2.756					30
inf.	1.282	1.645	1.960	2.326	2.576					inf.

*This table is adapted from Table IV of R. A. Fisher, *Statistical Methods for Research Workers*, 14th ed. by permission of Macmillan Publishing Co., Inc. Copyright © 1970 University of Adelaide.

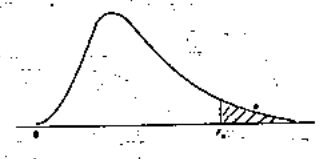


The entries in Table II are values for which the area to their right under the standard normal distribution with given degrees of freedom (the area of the white region under the curve shown above) is equal to α .

工設所 統計學 附表 6-4

TABLE IV Values of $F_{\alpha,0.01}$

Degrees of freedom for denominator	Degrees of freedom for numerator																		
	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161	200	216	223	230	234	237	239	241	242	244	246	248	249	250	251	252	253	254
2	18.5	19.0	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.5	19.5	19.5	19.5	19.5	19.5
3	10.1	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.37
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.45	2.42	2.38	2.34	2.30	2.25	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.38	2.35	2.31	2.27	2.22	2.18	2.13
15	4.54	3.68	3.28	3.05	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	4.45	3.59	3.20	2.97	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.20	2.15	2.10	2.06	2.01	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.12	2.07	2.03	1.98	1.93	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.35	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.51
60	4.00	3.15	2.76	2.53	2.37	2.26	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39
120	3.92	3.07	2.68	2.45	2.29	2.18	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.25
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00

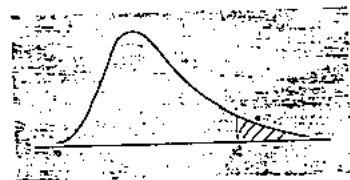


The entries in Table IV are values for which the area to their right under the F distribution with given degrees of freedom (the area of the white region under the curve shown above) is equal to α .

工設所 統計學 附表 6-3

TABLE III Values of χ^2_{α}

d.f.	$\chi^2_{0.995}$	$\chi^2_{0.99}$	$\chi^2_{0.975}$	$\chi^2_{0.95}$	$\chi^2_{0.9}$	$\chi^2_{0.8}$	$\chi^2_{0.7}$	$\chi^2_{0.6}$	$\chi^2_{0.5}$	d.f.
1	.0000393	.000157	.000062	.00393	3.841	6.024	6.635	7.879	10.828	1
2	.0100	.0201	.0600	.103	5.991	7.378	7.879	9.210	10.597	2
3	.0717	.116	.218	.354	7.879	9.348	11.345	12.838	14.164	3
4	.207	.297	.484	.711	9.488	11.141	13.277	14.860	16.766	4
5	.412	.564	.831	1.145	11.070	12.832	15.086	16.760	18.548	5
6	.872	1.239	1.637	2.204	12.592	14.449	16.812	18.548	20.278	6
7	1.344	1.679	2.179	2.746	14.067	15.013	18.475	20.278	22.037	7
8	1.646	1.848	2.336	2.897	15.507	16.013	19.533	21.955	23.542	8
9	1.735	1.928	2.366	2.915	16.919	16.919	20.483	22.760	24.461	9
10	1.902	2.000	2.366	2.915	18.307	17.535	21.315	23.581	25.188	10
11	2.054	2.064	2.366	2.915	19.675	18.151	22.161	24.433	26.011	11
12	2.179	2.121	2.366	2.915	21.026	18.758	22.979	25.219	26.751	12
13	2.279	2.171	2.366	2.915	22.362	19.348	23.745	26.009	27.488	13
14	2.364	2.218	2.366	2.915	23.685	19.921	24.461	26.751	28.191	14
15	2.434	2.262	2.366	2.915	24.996	20.479	25.119	27.488	28.845	15
16	2.497	2.303	2.366	2.915	26.296	21.021	25.721	28.191	29.490	16
17	2.554	2.342	2.366	2.915	27.587	21.549	26.271	28.845	30.191	17
18	2.606	2.378	2.366	2.915	28.869	22.064	26.771	29.490	30.841	18
19	2.654	2.412	2.366	2.915	30.143	22.567	27.221	30.191	31.526	19
20	2.698	2.443	2.366	2.915	31.410	23.059	27.721	30.841	32.178	20
21	2.739	2.472	2.366	2.915	32.671	23.541	28.171	31.526	32.797	21
22	2.777	2.499	2.366	2.915	33.924	24.013	28.621	32.178	33.397	22
23	2.812	2.524	2.366	2.915	35.172	24.476	29.061	32.797	33.978	23
24	2.844	2.548	2.366	2.915	36.415	24.931	29.491	33.401	34.541	24
25	2.874	2.570	2.366	2.915	37.652	25.378	29.911	34.011	35.081	25
26	2.902	2.591	2.366	2.915	38.885	25.817	30.321	34.541	35.601	26
27	2.928	2.610	2.366	2.915	40.113	26.248	30.721	35.081	36.111	27
28	2.952	2.628	2.366	2.915	41.337	26.671	31.111	35.601	36.611	28
29	2.974	2.645	2.366	2.915	42.557	27.087	31.481	36.111	37.101	29
30	2.994	2.661	2.366	2.915	43.773	27.497	31.841	36.611	37.581	30



The entries in Table III are values for which the area to their right under the chi-square distribution with given degrees of freedom (the area of the white region under the curve shown above) is equal to α .

TABLE V Values of r^{**}

r^{**}	1	2	3	4	5	6	7	8	9	10	12	15	20	30	40	60	120	r^{**}
0.0	1.000	2.5	0.082	3.0	0.0087	7.5	0.0015											
0.1	0.905	2.6	0.074	3.1	0.0081	7.7	0.0016											
0.2	0.819	2.7	0.067	3.2	0.0075	7.9	0.0017											
0.3	0.741	2.8	0.061	3.3	0.0069	8.1	0.0018											
0.4	0.670	2.9	0.055	3.4	0.0064	8.3	0.0019											
0.5	0.607	3.0	0.050	3.5	0.0061	8.5	0.0020											
0.6	0.549	3.1	0.045	3.6	0.0057	8.7	0.0021											
0.7	0.497	3.2	0.041	3.7	0.0053	8.9	0.0022											
0.8	0.449	3.3	0.037	3.8	0.0050	9.1	0.0023											
0.9	0.407	3.4	0.033	3.9	0.0047	9.3	0.0024											
1.0	0.368	3.5	0.030	4.0	0.0045	9.5	0.0025											
1.1	0.333	3.6	0.027	4.1	0.0042	9.7	0.0026											
1.2	0.301	3.7	0.025	4.2	0.0040	9.9	0.0027											
1.3	0.273	3.8	0.022	4.3	0.0038	10.1	0.0028											
1.4	0.247	3.9	0.020	4.4	0.0037	10.3	0.0029											
1.5	0.223	4.0	0.018	4.5	0.0035	10.5	0.0030											
1.6	0.202	4.1	0.017	4.6	0.0034	10.7	0.0031											
1.7	0.183	4.2	0.015	4.7	0.0032	10.9	0.0032											
1.8	0.165	4.3	0.014	4.8	0.0031	11.1	0.0033											
1.9	0.150	4.4	0.012	4.9	0.0030	11.3	0.0034											
2.0	0.135	4.5	0.011	5.0	0.0029	11.5	0.0035											
2.1	0.122	4.6	0.010	5.1	0.0028	11.7	0.0036											
2.2	0.111	4.7	0.009	5.2	0.0027	11.9	0.0037											
2.3	0.100	4.8	0.008	5.3	0.0026	12.1	0.0038											
2.4	0.091	4.9	0.007	5.4	0.0025	12.3	0.0039											

TABLE IV (Continued) Values of F_{α, n_1, n_2}

Degrees of freedom for numerator (分子)

Degrees of freedom for denominator (分母)	Degrees of freedom for numerator (分子)																		
	1	2	3	4	5	6	7	8	9	10	12	15	20	30	40	60	120	α	
1	4.052	5.000	5.403	5.675	5.764	5.859	5.928	5.982	6.023	6.056	6.106	6.157	6.209	6.255	6.261	6.287	6.313	6.339	6.366
2	48.5	39.0	39.2	39.2	39.1	39.1	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.5	39.5	39.5	39.5	39.5	39.5
3	34.1	30.8	29.5	28.7	28.2	27.9	27.7	27.5	27.3	27.2	27.1	26.9	26.7	26.6	26.5	26.4	26.3	26.2	26.1
4	21.2	18.0	16.7	16.0	15.5	15.2	15.0	14.8	14.7	14.5	14.4	14.2	14.0	13.9	13.8	13.7	13.7	13.6	13.5
5	16.5	13.5	12.1	11.4	11.0	10.7	10.5	10.3	10.2	10.1	9.9	9.7	9.5	9.4	9.3	9.2	9.1	9.0	8.9
6	13.7	10.9	9.7	9.1	8.7	8.4	8.2	8.1	7.9	7.8	7.7	7.5	7.4	7.3	7.2	7.1	7.0	6.9	6.8
7	12.2	9.5	8.4	7.8	7.4	7.1	6.9	6.8	6.7	6.6	6.4	6.3	6.1	6.0	5.9	5.8	5.7	5.6	5.5
8	11.1	8.5	7.5	7.0	6.6	6.3	6.1	6.0	5.9	5.8	5.6	5.5	5.3	5.2	5.1	5.0	4.9	4.8	4.7
9	10.4	8.0	6.9	6.4	6.0	5.8	5.6	5.5	5.4	5.3	5.1	5.0	4.8	4.7	4.6	4.5	4.4	4.3	4.2
10	10.0	7.5	6.5	5.9	5.6	5.3	5.2	5.0	4.9	4.8	4.7	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8
11	9.6	7.2	6.2	5.6	5.3	5.0	4.8	4.7	4.6	4.5	4.4	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5
12	9.3	6.9	5.9	5.4	5.0	4.8	4.6	4.5	4.3	4.3	4.1	4.0	3.8	3.7	3.6	3.5	3.4	3.3	3.2
13	9.0	6.7	5.7	5.2	4.8	4.6	4.4	4.3	4.1	4.1	3.9	3.8	3.6	3.5	3.4	3.3	3.2	3.1	3.0
14	8.8	6.5	5.5	5.0	4.7	4.4	4.2	4.1	4.0	3.9	3.8	3.6	3.5	3.4	3.3	3.2	3.1	3.0	2.9
15	8.6	6.3	5.4	4.8	4.5	4.2	4.1	4.0	3.8	3.8	3.6	3.5	3.3	3.2	3.1	3.0	2.9	2.8	2.7
16	8.5	6.2	5.2	4.7	4.4	4.2	4.0	3.9	3.7	3.7	3.5	3.4	3.2	3.1	3.0	2.9	2.8	2.7	2.6
17	8.4	6.1	5.1	4.6	4.3	4.0	3.9	3.8	3.6	3.6	3.4	3.3	3.1	3.0	2.9	2.8	2.7	2.6	2.5
18	8.2	6.0	5.0	4.5	4.2	4.0	3.8	3.7	3.5	3.5	3.3	3.2	3.0	2.9	2.8	2.7	2.6	2.5	2.4
19	8.1	5.9	5.0	4.5	4.1	3.9	3.7	3.6	3.4	3.4	3.2	3.1	2.9	2.8	2.7	2.6	2.5	2.4	2.3
20	8.0	5.8	4.9	4.4	4.1	3.8	3.7	3.5	3.4	3.3	3.1	3.0	2.8	2.7	2.6	2.5	2.4	2.3	2.2
21	8.0	5.7	4.8	4.3	4.0	3.8	3.6	3.5	3.3	3.2	3.0	2.9	2.7	2.6	2.5	2.4	2.3	2.2	2.1
22	7.9	5.7	4.8	4.3	3.9	3.7	3.5	3.4	3.2	3.1	2.9	2.8	2.6	2.5	2.4	2.3	2.2	2.1	2.0
23	7.8	5.6	4.7	4.2	3.9	3.7	3.5	3.4	3.2	3.1	2.9	2.8	2.6	2.5	2.4	2.3	2.2	2.1	2.0
24	7.8	5.6	4.7	4.2	3.9	3.7	3.5	3.4	3.2	3.1	2.9	2.8	2.6	2.5	2.4	2.3	2.2	2.1	2.0
25	7.7	5.5	4.6	4.1	3.8	3.6	3.4	3.3	3.1	3.0	2.8	2.7	2.5	2.4	2.3	2.2	2.1	2.0	1.9
30	7.5	5.3	4.5	4.0	3.7	3.4	3.3	3.1	3.0	2.9	2.7	2.6	2.4	2.3	2.2	2.1	2.0	1.9	1.8
40	7.3	5.1	4.3	3.8	3.5	3.2	3.1	2.9	2.8	2.7	2.5	2.4	2.2	2.1	2.0	1.9	1.8	1.7	1.6
60	7.0	4.9	4.1	3.6	3.3	3.1	2.9	2.8	2.7	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.7	1.6	1.5
120	6.8	4.7	3.9	3.4	3.1	2.9	2.7	2.6	2.5	2.4	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3
α	6.5	4.6	3.7	3.2	3.0	2.8	2.6	2.5	2.4	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2

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