ACC1012/ACC1013

Professional Skills for Accounting and Finance

Formulae and Statistical Tables

2013—2014

1 Linear/non–linear equations

For the linear equation $y = mx + c$, which passes through the points (x_1, y_1) and (x_2, y_2), the gradient m can be found as

$$m = \frac{y_2 - y_1}{x_2 - x_1}.$$

For the quadratic equation $y = ax^2 + bx + c$, the discriminant D is

$$D = b^2 - 4ac.$$

The solution(s) for x when $y = 0$ can be found at

$$x = \frac{-b \pm \sqrt{D}}{2a}.$$

2 Sample statistics

Lower quartile: $Q_1 = \frac{(n+1)}{4}$th smallest observation.

Median: $Q_2 = \frac{(n+1)}{2}$th smallest observation.

Upper quartile: $Q_3 = \frac{3(n+1)}{4}$th smallest observation.

Sample mean (raw): $\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$

Sample mean (table): $\bar{x} = \frac{1}{n}\sum_{j=1}^{k} x_{(j)} f_j$

Sample st. dev. (raw): $s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2} = \sqrt{\frac{1}{n-1}\left\{\sum_{i=1}^{n} x_i^2 - n\bar{x}^2\right\}}$

3 Combining probabilities

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

If A and B are independent then

$$P(A \text{ and } B) = P(A)P(B)$$

4 Probability distributions

Discrete distributions	$\Pr(X = r)$	Mean	Variance
Binomial, $X \sim \text{Bin}(n, p)$	${}^n\text{C}_r p^r (1-p)^{n-r}$	np	$np(1-p)$
Poisson, $X \sim \text{Po}(\lambda)$	$\dfrac{e^{-\lambda}\lambda^r}{r!}$	λ	λ

Continuous distributions	$\Pr(X \leq x)$	Mean	Variance
Uniform, $X \sim U(a, b)$	$\dfrac{x-a}{b-a}$	$\dfrac{a+b}{2}$	$\dfrac{(b-a)^2}{12}$
Exponential, $X \sim \text{Exp}(\lambda)$	$1 - e^{-\lambda x}$	$1/\lambda$	$1/\lambda^2$
Normal, $X \sim N(\mu, \sigma^2)$	$P\left(z \leq \dfrac{x-\mu}{\sigma}\right)$, where $z \sim N(0,1)$	μ	σ^2

5 Statistical inference for the population mean

Confidence interval for the population mean μ

σ known: $\bar{x} \pm z \times \sigma/\sqrt{n}$; where z is a critical value from $N(0, 1)$

σ unknown: $\bar{x} \pm t \times s/\sqrt{n}$; where t is a critical value from a t_{n-1} distribution

Hypothesis tests

Hypothesis test	Test statistic	Other comments
Tests for one mean		
→ σ known	$z = \dfrac{\lvert\bar{x} - \mu\rvert}{\sigma/\sqrt{n}}$	
→ σ unknown	$t = \dfrac{\lvert\bar{x} - \mu\rvert}{s/\sqrt{n}}$	$\text{df} = n - 1$
Tests for two means [Independent samples]		
→ σ_1, σ_2 known	$z = \dfrac{\lvert\bar{x}_1 - \bar{x}_2\rvert}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$	
→ σ_1, σ_2 unknown	$t = \dfrac{\lvert\bar{x}_1 - \bar{x}_2\rvert}{s_p \times \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$	$s_p = \sqrt{\dfrac{(n_1 - 1)\, s_1^2 + (n_2 - 1)\, s_2^2}{n_1 + n_2 - 2}}$ $\text{df} = n_1 + n_2 - 2$

6 Correlation and regression

The sample correlation coefficient is given by

$$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}},$$

where

$$\begin{aligned} S_{xy} &= \sum xy - n\bar{x}\bar{y}, \\ S_{xx} &= \sum x^2 - n\bar{x}^2, \qquad \text{and} \\ S_{yy} &= \sum y^2 - n\bar{y}^2. \end{aligned}$$

The *simple* linear regression equation is given by

$$y = \beta_0 + \beta_1 x + \epsilon,$$

where $\epsilon \sim N\left(0, \sigma^2\right)$ and β_0 and β_1 can be estimated using

$$\begin{aligned} \hat{\beta}_1 &= \frac{S_{xy}}{S_{xx}} \qquad \text{and} \\ \hat{\beta}_0 &= \bar{y} - \hat{\beta}_1 \bar{x}. \end{aligned}$$

The *multiple* linear regression equation, with p predictor variables, is given by

$$y = \beta_0 + \sum_{i=1}^{p} \beta_i x_i + \epsilon,$$

where $\epsilon \sim N\left(0, \sigma^2\right)$.

In a test of $H_0 : \beta_i = 0$,

$$T = \frac{\hat{\beta}_i}{\text{s.e.}(\hat{\beta}_i)} \sim t_{n-p-1}$$

when H_0 is true.

7 Statistical tables

				p		
	One–tailed test	10%	5%	2.5%	1%	0.5%
	Two–tailed test	20%	10%	5%	2%	1%
	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	3.449
	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
ν	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
	30	1.310	1.697	2.042	2.457	2.750
	31	1.309	1.696	2.040	2.453	2.744
	32	1.309	1.694	2.037	2.449	2.738
	33	1.308	1.692	2.035	2.445	2.733
	34	1.307	1.691	2.032	2.441	2.728
	35	1.306	1.690	2.030	2.438	2.724
	36	1.306	1.688	2.028	2.434	2.719
	37	1.305	1.687	2.026	2.431	2.715
	38	1.304	1.686	2.024	2.429	2.712
	39	1.304	1.685	2.023	2.426	2.708
	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
	∞	1.282	1.645	1.960	2.326	2.576

Table 1: This table contains values of t for which $\Pr(T > t) = p$, where $T \sim t_\nu$. In a two–tailed test, the tabulated values correspond to $\Pr(|T| > t) = p$

z	-0.09	-0.08	-0.07	-0.06	-0.05	-0.04	-0.03	-0.02	-0.01	0.00
-3.0	0.0000	0.0000	0.0001	0.0002	0.0002	0.0003	0.0005	0.0007	0.0010	0.0013
-2.9	0.0014	0.0014	0.0015	0.0015	0.0016	0.0016	0.0017	0.0018	0.0018	0.0019
-2.8	0.0019	0.0020	0.0021	0.0021	0.0022	0.0023	0.0023	0.0024	0.0025	0.0026
-2.7	0.0026	0.0027	0.0028	0.0029	0.0030	0.0031	0.0032	0.0033	0.0034	0.0035
-2.6	0.0036	0.0037	0.0038	0.0039	0.0040	0.0041	0.0043	0.0044	0.0045	0.0047
-2.5	0.0048	0.0049	0.0051	0.0052	0.0054	0.0055	0.0057	0.0059	0.0060	0.0062
-2.4	0.0064	0.0066	0.0068	0.0069	0.0071	0.0073	0.0075	0.0078	0.0080	0.0082
-2.3	0.0084	0.0087	0.0089	0.0091	0.0094	0.0096	0.0099	0.0102	0.0104	0.0107
-2.2	0.0110	0.0113	0.0116	0.0119	0.0122	0.0125	0.0129	0.0132	0.0136	0.0139
-2.1	0.0143	0.0146	0.0150	0.0154	0.0158	0.0162	0.0166	0.0170	0.0174	0.0179
-2.0	0.0183	0.0188	0.0192	0.0197	0.0202	0.0207	0.0212	0.0217	0.0222	0.0228
-1.9	0.0233	0.0239	0.0244	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287
-1.8	0.0294	0.0301	0.0307	0.0314	0.0322	0.0329	0.0336	0.0344	0.0351	0.0359
-1.7	0.0367	0.0375	0.0384	0.0392	0.0401	0.0409	0.0418	0.0427	0.0436	0.0446
-1.6	0.0455	0.0465	0.0475	0.0485	0.0495	0.0505	0.0516	0.0526	0.0537	0.0548
-1.5	0.0559	0.0571	0.0582	0.0594	0.0606	0.0618	0.0630	0.0643	0.0655	0.0668
-1.4	0.0681	0.0694	0.0708	0.0721	0.0735	0.0749	0.0764	0.0778	0.0793	0.0808
-1.3	0.0823	0.0838	0.0853	0.0869	0.0885	0.0901	0.0918	0.0934	0.0951	0.0968
-1.2	0.0985	0.1003	0.1020	0.1038	0.1056	0.1075	0.1093	0.1112	0.1131	0.1151
-1.1	0.1170	0.1190	0.1210	0.1230	0.1251	0.1271	0.1292	0.1314	0.1335	0.1357
-1.0	0.1379	0.1401	0.1423	0.1446	0.1469	0.1492	0.1515	0.1539	0.1562	0.1587
-0.9	0.1611	0.1635	0.1660	0.1685	0.1711	0.1736	0.1762	0.1788	0.1814	0.1841
-0.8	0.1867	0.1894	0.1922	0.1949	0.1977	0.2005	0.2033	0.2061	0.2090	0.2119
-0.7	0.2148	0.2177	0.2206	0.2236	0.2266	0.2296	0.2327	0.2358	0.2389	0.2420
-0.6	0.2451	0.2483	0.2514	0.2546	0.2578	0.2611	0.2643	0.2676	0.2709	0.2743
-0.5	0.2776	0.2810	0.2843	0.2877	0.2912	0.2946	0.2981	0.3015	0.3050	0.3085
-0.4	0.3121	0.3156	0.3192	0.3228	0.3264	0.3300	0.3336	0.3372	0.3409	0.3446
-0.3	0.3483	0.3520	0.3557	0.3594	0.3632	0.3669	0.3707	0.3745	0.3783	0.3821
-0.2	0.3859	0.3897	0.3936	0.3974	0.4013	0.4052	0.4090	0.4129	0.4168	0.4207
-0.1	0.4247	0.4286	0.4325	0.4364	0.4404	0.4443	0.4483	0.4522	0.4562	0.4602
0.0	0.4641	0.4681	0.4721	0.4761	0.4801	0.4840	0.4880	0.4920	0.4960	0.5000

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9990	0.9993	0.9995	0.9997	0.9998	0.9998	0.9999	0.9999	0.9999

Table 2: This table contains values of $\Pr(Z < z)$, where $Z \sim N(0, 1)$