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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2011/2012

COURSE NAME	:	STATISTICS FOR MANAGEMENT
COURSE CODE	:	BWM11003 / BSM1823
PROGRAMME	:	BACHELOR OF TECHNOLOGY MANAGEMENT
EXAMINATION DATE	:	JUNE 2012
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **TWELVE (12)** PAGES

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Q1 (a) Table 1 is an ANOVA table.

Table 1: ANOVA Table

Source of Variation	Degree of Freedom	Sums of Squares	Mean Squares	F-Statistic
Treatments	A	57 512.23	D	E
Error	B	C	8 894.45	
Total	59	564 495.73		

(i) State the null hypothesis and the alternative hypothesis.
(ii) Calculate the value for each A, B, C, D and E.
(iii) Give your conclusion regarding to the null hypothesis. Use $\alpha = 0.05$.

(10 marks)

(b) A benefit of sport exercise is that it raises the metabolism rate. In a study to determine the effect of different durations of the exercise and the metabolism rate, a sample of 100 regular exercises was drawn. The amount of time each individual exercised was measured. The coefficients were given below:

$$\sum x = 4\ 055; \quad \sum x^2 = 176\ 149;$$
$$\sum y = 12\ 969; \quad \sum y^2 = 1\ 787\ 027; \quad \sum xy = 553\ 642.$$

(i) Determine the sample regression line that depicts how the metabolism rate is affected by the amount of exercise.
(ii) State the meaning for each value of $\hat{\beta}_0$ and $\hat{\beta}_1$.

(10 marks)

Q2 (a) Random sampling from two normal populations produced the following results:

$$\bar{x}_1 = 63; \quad s_1 = 8; \quad n_1 = 25$$
$$\bar{x}_2 = 60; \quad s_2 = 7; \quad n_2 = 20$$

Test the claim that μ_1 is greater than μ_2 by using $\alpha = 0.10$. Assume that the population variances are unknown but equal.

(10 marks)

(b) A researcher wishes to test the claim that the standard deviation of lifeguards in Silver Island is difference than 3.4 years. He selects a sample of 16 guards and finds the standard deviation of 6 years.

Test the hypothesis by using $\alpha = 0.01$.

(10 marks)

Q3 (a) The amount of time the university professors devote to their jobs per week is normally distributed with mean $\mu = 52$ hours and standard deviation $\sigma = 6$ hours.

(i) Calculate the probability that a professor works for more than 60 hours per week.

(ii) Calculate the probability that the mean amount of work per week for three randomly selected professors is more than 60 hours.

(iii) Calculate the probability that, if three professors are randomly selected, all three of them work for more than 60 hours per week.

(10 marks)

(b) The following observations are the ages of a random sample of eight men in a restaurant. It is known that the ages are normally distributed with a standard deviation of 10.

52, 68, 22, 35, 30, 56, 39, 48

Determine the 95% confidence interval of the population mean.

(10 marks)

Q4 (a) From a hospital, pregnancy test results were given in Table 2.

Table 2: Test Results

Subject	Positive Test Result (Pregnancy is indicated)	Negative Test Result (Pregnancy is not indicated)
Pregnant	80	5
Not Pregnant	3	11

Assume that one of the subjects is randomly selected.

(i) Determine the probability that the person tested positive given that she was pregnant.

(ii) Determine the probability that she was pregnant given that she tested positive.

(iii) Determine the probability of a negative test result given that the selected subject is not pregnant.

(iv) Determine the probability that the selected subject is not pregnant given that the test was negative.

(8 marks)

(b) Given that the prior probabilities $P(B_1) = 0.6$ and $P(B_2) = 0.4$, and the conditional probabilities $P(A \mid B_1) = 0.65$ and $P(A \mid B_2) = 0.45$.

Table 3: Tabular Approach

Events B_i	Prior Probabilities $P(B_i)$	Conditional Probabilities $P(A \mid B_i)$	Joint Probabilities $P(B_i \cap A)$	Posterior Probabilities $P(B_i \mid A)$
B_1 B_2				
	1.00			1.00

Complete Table 3 and state the posterior probabilities $P(B_1 \mid A)$ and $P(B_2 \mid A)$.

(12 marks)

Q5 (a) A random variable has the following density function:

$$f(x) = 1 - 0.5x,\ 0 < x < 2.$$

(i) Draw the graph of the density function.
(ii) Compute $P(X > 1)$.
(iii) Compute $P(X < 0.5)$.
(iv) Compute $P(X = 1.5)$.

(10 marks)

(b) Textbook authors and publishers work very hard to minimize the number of errors in a text. However, some errors are unavoidable. A statistics editor reports that the mean number of errors per chapter is 0.8.

(i) State the specific probability distribution for the number of errors.
(ii) Give the formula that used for the probability distribution mentioned in part (i).
(iii) Calculate the probability that there are less than two errors in a particular chapter.
(iv) Calculate the probability that there is at least one error in two chapters.

(10 marks)

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TABLE 2 CUMULATIVE POISSON PROBABILITIES

m =	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
r = 0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1	0.0952	0.1813	0.2592	0.3297	0.3935	0.4512	0.5034	0.5507	0.5934	0.6321
2	0.0047	0.0175	0.0369	0.0616	0.0902	0.1219	0.1558	0.1912	0.2275	0.2642
3	0.0002	0.0011	0.0036	0.0079	0.0144	0.0231	0.0341	0.0474	0.0629	0.0803
4		0.0001	0.0003	0.0008	0.0018	0.0034	0.0058	0.0091	0.0135	0.0190
5			0.0000	0.0001	0.0002	0.0004	0.0008	0.0014	0.0023	0.0037
6					0.0000	0.0000	0.0001	0.0002	0.0003	0.0006
7								0.0000	0.0000	0.0001
8										0.0000

m =	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
r = 0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1	0.6321	0.6671	0.6988	0.7275	0.7534	0.7769	0.7981	0.8173	0.8347	0.8504
2	0.2642	0.3010	0.3374	0.3732	0.4082	0.4422	0.4751	0.5068	0.5372	0.5663
3	0.0803	0.0996	0.1205	0.1429	0.1665	0.1912	0.2166	0.2428	0.2694	0.2963
4	0.0190	0.0257	0.0338	0.0431	0.0537	0.0656	0.0788	0.0932	0.1087	0.1253
5	0.0037	0.0054	0.0077	0.0107	0.0143	0.0186	0.0237	0.0296	0.0364	0.0441
6	0.0006	0.0010	0.0015	0.0022	0.0032	0.0045	0.0060	0.0080	0.0104	0.0132
7	0.0001	0.0001	0.0003	0.0004	0.0006	0.0009	0.0013	0.0019	0.0026	0.0034
8	0.0000	0.0000	0.0000	0.0001	0.0001	0.0002	0.0003	0.0004	0.0006	0.0008
9					0.0000	0.0000	0.0000	0.0001	0.0001	0.0002
10								0.0000	0.0000	0.0000

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TABLE 3 AREA IN TAIL OF THE NORMAL DISTRIBUTION

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	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.02275	0.02222	0.02169	0.02118	0.02068	0.02018	0.01970	0.01923	0.01876	0.01831
2.1	0.01786	0.01743	0.01700	0.01659	0.01618	0.01578	0.01539	0.01500	0.01463	0.01426
2.2	0.01390	0.01355	0.01321	0.01287	0.01255	0.01222	0.01191	0.01160	0.01130	0.01101
2.3	0.01072	0.01044	0.01017	0.00990	0.00964	0.00939	0.00914	0.00889	0.00866	0.00842
2.4	0.00820	0.00798	0.00776	0.00755	0.00734	0.00714	0.00695	0.00676	0.00657	0.00639
2.5	0.00621	0.00604	0.00587	0.00570	0.00554	0.00539	0.00523	0.00508	0.00494	0.00480
2.6	0.00466	0.00453	0.00440	0.00427	0.00415	0.00402	0.00391	0.00379	0.00368	0.00357
2.7	0.00347	0.00336	0.00326	0.00317	0.00307	0.00298	0.00289	0.00280	0.00272	0.00264
2.8	0.00256	0.00248	0.00240	0.00233	0.00226	0.00219	0.00212	0.00205	0.00199	0.00193
2.9	0.00187	0.00181	0.00175	0.00169	0.00164	0.00159	0.00154	0.00149	0.00144	0.00139
3.0	0.00135	0.00131	0.00126	0.00122	0.00118	0.00114	0.00111	0.00107	0.00104	0.00100

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TABLE 4 PERCENTAGE POINTS OF THE t DISTRIBUTION

	α =	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
ν =	1	3.078	6.314	12.706	31.821	63.657	318.31	636.62
	2	1.886	2.920	4.303	6.965	9.925	22.327	31.599
	3	1.638	2.353	3.182	4.541	5.841	10.215	12.924
	4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
	5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
	6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
	7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
	8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
	9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
	10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
	11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
	12	1.356	1.782	2.179	2.681	3.055	3.930	4.318
	13	1.350	1.771	2.160	2.650	3.012	3.852	4.221
	14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
	15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
	16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
	17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
	18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
	19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
	20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
	21	1.323	1.721	2.080	2.518	2.831	3.527	3.819
	22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
	23	1.319	1.714	2.069	2.500	2.807	3.485	3.768
	24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
	25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
	26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
	27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
	28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
	29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
	30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
	40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
	60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
	80	1.292	1.664	1.990	2.374	2.639	3.195	3.416
	100	1.290	1.660	1.984	2.364	2.626	3.174	3.390

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TABLE 5 PERCENTAGE POINTS OF THE $\chi 2$ DISTRIBUTION

	α =	0.995	0.99	0.98	0.975	0.95	0.90	0.80	0.75	0.70	0.50
ν =	1	0.000039	0.000157	0.000628	0.000982	0.00393	0.0158	0.0642	0.102	0.148	0.455
	2	0.0100	0.0201	0.0404	0.0506	0.103	0.211	0.446	0.575	0.713	1.386
	3	0.0717	0.115	0.185	0.216	0.352	0.584	1.005	1.213	1.424	2.366
	4	0.207	0.297	0.429	0.484	0.711	1.064	1.649	1.923	2.195	3.357
	5	0.412	0.554	0.752	0.831	1.145	1.610	2.343	2.675	3.000	4.351
	6	0.676	0.872	1.134	1.237	1.635	2.204	3.070	3.455	3.828	5.348
	7	0.989	1.239	1.564	1.690	2.167	2.833	3.822	4.255	4.671	6.346
	8	1.344	1.646	2.032	2.180	2.733	3.490	4.594	5.071	5.527	7.344
	9	1.735	2.088	2.532	2.700	3.325	4.168	5.380	5.899	6.393	8.343
	10	2.156	2.558	3.059	3.247	3.940	4.865	6.179	6.737	7.267	9.342
	11	2.603	3.053	3.609	3.816	4.575	5.578	6.989	7.584	8.148	10.341
	12	3.074	3.571	4.178	4.404	5.226	6.304	7.807	8.438	9.034	11.340
	13	3.565	4.107	4.765	5.009	5.892	7.042	8.634	9.299	9.926	12.340
	14	4.075	4.660	5.368	5.629	6.571	7.790	9.467	10.165	10.821	13.339
	15	4.601	5.229	5.985	6.262	7.261	8.547	10.307	11.037	11.721	14.339
	16	5.142	5.812	6.614	6.908	7.962	9.312	11.152	11.912	12.624	15.338
	17	5.697	6.408	7.255	7.564	8.672	10.085	12.002	12.792	13.531	16.338
	18	6.265	7.015	7.906	8.231	9.390	10.865	12.857	13.675	14.440	17.338
	19	6.844	7.633	8.567	8.907	10.117	11.651	13.716	14.562	15.352	18.338
	20	7.434	8.260	9.237	9.591	10.851	12.443	14.578	15.452	16.266	19.337

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0.30	0.25	0.20	0.10	0.05	0.025	0.02	0.01	0.005	0.001	= α
1.074	1.323	1.642	2.706	3.841	5.024	5.412	6.635	7.879	10.828	ν = 1
2.408	2.773	3.219	4.605	5.991	7.378	7.824	9.210	10.597	13.816	2
3.665	4.108	4.642	6.251	7.815	9.348	9.837	11.345	12.838	16.266	3
4.878	5.385	5.989	7.779	9.488	11.143	11.668	13.277	14.860	18.467	4
6.064	6.626	7.289	9.236	11.070	12.833	13.388	15.086	16.750	20.515	5
7.231	7.841	8.558	10.645	12.592	14.449	15.033	16.812	18.548	22.458	6
8.383	9.037	9.803	12.017	14.067	16.013	16.622	18.475	20.278	24.322	7
9.524	10.219	11.030	13.362	15.507	17.535	18.168	20.090	21.955	26.124	8
10.656	11.389	12.242	14.684	16.919	19.023	19.679	21.666	23.589	27.877	9
11.781	12.549	13.442	15.987	18.307	20.483	21.161	23.209	25.188	29.588	10
12.899	13.701	14.631	17.275	19.675	21.920	22.618	24.725	26.757	31.264	11
14.011	14.845	15.812	18.549	21.026	23.337	24.054	26.217	28.300	32.909	12
15.119	15.984	16.985	19.812	22.362	24.736	25.472	27.688	29.819	34.528	13
16.222	17.117	18.151	21.064	23.685	26.119	26.873	29.141	31.319	36.123	14
17.322	18.245	19.311	22.307	24.996	27.488	28.259	30.578	32.801	37.697	15
18.418	19.369	20.465	23.542	26.296	28.845	29.633	32.000	34.267	39.252	16
19.511	20.489	21.615	24.769	27.587	30.191	30.995	33.409	35.718	40.790	17
20.601	21.605	22.760	25.989	28.869	31.526	32.346	34.805	37.156	42.312	18
21.689	22.718	23.900	27.204	30.144	32.852	33.687	36.191	38.582	43.820	19
22.775	23.828	25.038	28.412	31.410	34.170	35.020	37.566	39.997	45.315	20

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TABLE 6 PERCENTAGE POINTS OF THE F DISTRIBUTION $\alpha = 0.05$

	ν1 =	1	2	3	4	5	6	7	8	10
ν2 =	1	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	241.88
	2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.40
	3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.79
	4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	5.96
	5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.74
	6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.06
	7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.64
	8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.35
	9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.14
	10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	2.98
	11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.85
	12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.75
	13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.67
	14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.60
	15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.54
	16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.49
	17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.45
	18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.41
	19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.38
	20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.35
	22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.30
	24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.25
	26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.22
	28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.19
	30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.16
	40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.08
	60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	1.99
	80	3.96	3.11	2.72	2.49	2.33	2.21	2.13	2.06	1.95
	100	3.94	3.09	2.70	2.46	2.31	2.19	2.10	2.03	1.93

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2011/2012 PROGRAMME : 1BPA, 1BPB, 1BPC
COURSE : STATISTICS FOR MANAGEMENT COURSE CODE : BWM11003/BSM1823

STATISTICAL FORMULAS

Probability :

$$P(B_i \cap A) = P(B_i)P(A \mid B_i), \quad P(A) = \sum_{i=1}^{k} P(B_i \cap A) = \sum_{i=1}^{k} P(B_i)P(A \mid B_i)$$

Random Variables :

$$\sum_{i=-\infty}^{\infty} P(x_i) = 1, \qquad E(X) = \sum_{\forall x} x \cdot P(x), \qquad E(X^2) = \sum_{\forall x} x^2 \cdot P(x),$$

$$\int_{-\infty}^{\infty} f(x)\,dx = 1, \quad E(X) = \int_{-\infty}^{\infty} x \cdot P(x)\,dx, \quad E(X^2) = \int_{-\infty}^{\infty} x^2 \cdot P(x)\,dx,$$

$$Var(X) = E(X^2) - [E(X)]^2.$$

Special Probability Distributions :

$$X \sim B(n, p), \; P(x = r) = {}^nC_r \cdot p^r \cdot q^{n-r}, \; r = 0, 1, \ldots, n,$$

$$X \sim P_0(\mu), \; P(X = r) = \frac{e^{-\mu} \cdot \mu^r}{r!}, \; r = 0, 1, \ldots, \infty, \quad X \sim N(\mu, \sigma^2), \; Z \sim N(0, 1),$$

$$Z = \frac{X - \mu}{\sigma}.$$

Sampling Distributions :

$$\bar{X} \sim N(\mu, \sigma^2/n), \; \bar{X}_1 - \bar{X}_2 \sim N\left(\mu_1 - \mu_2, \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}\right), \; Z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}} \sim N(0, 1), \; T = \frac{\bar{x} - \mu}{s/\sqrt{n}}.$$

Estimations :

$$n = \left(\frac{Z_{\alpha/2} \cdot \sigma}{E}\right)^2, \; \left(\bar{x}_1 - \bar{x}_2\right) - Z_{\alpha/2}\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}} < \mu_1 - \mu_2 < \left(\bar{x}_1 - \bar{x}_2\right) + Z_{\alpha/2}\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}},$$

$$\left(\bar{x}_1 - \bar{x}_2\right) - Z_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} < \mu_1 - \mu_2 < \left(\bar{x}_1 - \bar{x}_2\right) + Z_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}},$$

$$\left(\bar{x}_1 - \bar{x}_2\right) - t_{\alpha/2,v} \cdot S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}} < \mu_1 - \mu_2 < \left(\bar{x}_1 - \bar{x}_2\right) + t_{\alpha/2,v} \cdot S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

where the pooled estimate of variance is $S_p^2 = \dfrac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$ with $v = n_1 + n_2 - 2$,

$$\left(\bar{x}_1 - \bar{x}_2\right) - t_{\alpha/2,v}\sqrt{\frac{1}{n}\left(s_1^2 + s_2^2\right)} < \mu_1 - \mu_2 < \left(\bar{x}_1 - \bar{x}_2\right) + t_{\alpha/2,v}\sqrt{\frac{1}{n}\left(s_1^2 + s_2^2\right)} \text{ with } v = 2(n-1),$$

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$$\left(\bar{x}_1-\bar{x}_2\right)-t_{\alpha/2,v}\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}<\mu_1-\mu_2<\left(\bar{x}_1-\bar{x}_2\right)+t_{\alpha/2,v}\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}} \text{ with } v=\frac{\left(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1-1}+\frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2-1}},$$

$$\frac{(n-1)\cdot s^2}{\chi^2_{\alpha/2,v}}<\sigma^2<\frac{(n-1)\cdot s^2}{\chi^2_{1-\alpha/2,v}} \text{ with } v=n-1,$$

$$\frac{s_1^2}{s_2^2}\cdot\frac{1}{f_{\alpha/2}(v_1,v_2)}<\frac{\sigma_1^2}{\sigma_2^2}<\frac{s_1^2}{s_2^2}\cdot f_{\alpha/2}(v_2,v_1) \text{ with } v_1=n_1-1 \text{ and } v_2=n_2-1.$$

Hypothesis Testing :

$$Z=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}},\ T=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{S_p\cdot\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \text{ with } v=n_1+n_2-2,$$

$$Z=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}},\ T=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{1}{n}\left(s_1^2+s_2^2\right)}},\ T=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}},$$

$$v=\frac{\left(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1-1}+\frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2-1}};\ S_p^2=\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2};\ \chi^2=\frac{(n-1)s^2}{\sigma^2};\ F=\frac{\sigma_2^2S_1^2}{\sigma_1^2S_2^2}.$$

Simple Linear Regressions :

$$S_{xy}=\sum x_iy_i-\frac{\sum x_i\cdot\sum y_i}{n},\ S_{xx}=\sum x_i^2-\frac{\left(\sum x_i\right)^2}{n},\ S_{yy}=\sum y_i^2-\frac{\left(\sum y_i\right)^2}{n},\ \bar{x}=\frac{\sum x_i}{n},$$

$$\bar{y}=\frac{\sum y_i}{n},\ \hat{\beta}_1=\frac{S_{xy}}{S_{xx}},\ \hat{\beta}_0=\bar{y}-\hat{\beta}_1\bar{x},\ \hat{y}=\hat{\beta}_0+\hat{\beta}_1x,\ r=\frac{S_{xy}}{\sqrt{S_{xx}\cdot S_{yy}}},\ SSE=S_{yy}-\hat{\beta}_1S_{xy},$$

$$MSE=\frac{SSE}{n-2},\ T=\frac{\hat{\beta}_1-\beta_1^*}{\sqrt{\frac{MSE}{S_{xx}}}}\sim t_{n-2},\ T=\frac{\hat{\beta}_0-\beta_0^*}{\sqrt{MSE\left(\frac{1}{n}+\frac{\bar{x}^2}{S_{xx}}\right)}}\sim t_{n-2}.$$