

一、(20分) 某工程主要項目如下：

項目		前置作業	平均工期	標準差
1	基礎開挖	---	20	12
2	基腳施工	1	10	7
3	基礎牆	2	30	10
4	切割單元	---	50	8
5	運至工地	4	20	4
6	結構組合	3,5	30	10
7	內部裝修	6	20	8

假設各項工程之工期呈標準常態分佈，且彼此相互獨立。

(一)請問其要徑為何？可能完工時程為何？(10%)

(二)若工項3落後2天且工項5落後5天，請問本工程能於130天內完工之機率為何？(10%)

二、(20分)某工地之混凝土抽樣試體強度經每組抽三或四試體後，每試體測試結果資料如下(單位: kgf/cm<sup>2</sup>)：

組別	1	2	3	4	5	6	7	8	9	10
試體一之強度	230	270	280	280	220	220	260	210	200	240
試體二之強度	260	230	210	270	200	265	220	170	230	250
試體三之強度	200	110	220	210	200	365	230	240	220	230
試體四之強度	****	240	230	****	****	260	****	220	****	240

(一)請算出此混凝土抽樣試體強度之平均值、標準差、及變異係數(10分)

(二)請檢定「此工地混凝土抽樣每組強度不小於設計強度 240 kgf/cm<sup>2</sup>」的推論是否正確？(10分)

註：顯著水準  $\alpha=0.05$ , t 分配之資料如下表： $t(1-\alpha, \nu)$

自由度 $\nu$	1	2	3	4	5	6	7	8	9	10
$t(0.95, \nu)$	6.314	2.920	2.353	2.132	2.015	1.943	1.895	1.860	1.833	1.812

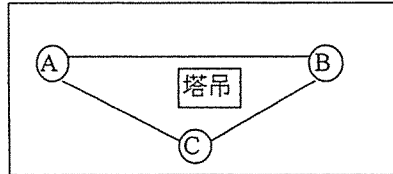
三、(20分) 請回答下列英文題目：A sample standard deviation for the number of rebar sets (per truck) taking a particular construction truck company is 8 units. A 95% confidence interval estimate of the population standard deviation is 5.82 units to 12.60 units.

(a) Was a sample size of 10 or 15 used in the statistical analysis? (10%)

(b) If the sample standard deviation of  $s = 8$  has been based on a simple of 25 trucks, what change would you expect in the confidence interval for the population standard deviation? Compute a 95% confidence interval estimate of  $\sigma$  with a sample of size of 25. (10%)

見背面

- 四、(20分) 在某一工地內，A 區與 B 區的動線圖如下。當塔吊在運行時，因安全考量 A、B 與 C 區之動線並非暢行無阻。設  $E_1$ 、 $E_2$ 、 $E_3$  分別代表動線 AB, AC, 與 CB 開放的事件。在任何一天之中，假設： $P(E_1) = 2/5$ ,  $P(E_2) = 3/4$ ,  $P(E_3) = 2/3$ ,  $P(E_3 | E_2) = 4/5$ ,  $P(E_1 | E_2 E_3) = 1/2$ 。



- (一) 請問某建材能由 A 區經 C 區運至 B 區的或然率為若干? 又該建材由 A 區運至 B 區的或然率為若干?(10%)
- (二) 請問有建材要運至 B 區，它應先嘗試何條動線，才能使它運至 B 區的機會為最大?(10%)

- 五、(20分) 某工地之混凝土是由三個不同來源的骨材，送至二個不同的拌合廠拌合，製成預拌混凝土供這工地使用，經分組抽三試體後，每試體測試結果資料如下(單位:  $\text{kgf/cm}^2$ )：

骨材	A		B		C	
	甲	乙	甲	乙	甲	乙
試體	290	210	230	270	280	290
	230	220	230	250	280	270
	250	210	270	260	300	275

若此試體資料適合作變異數分析，則試取  $\alpha = 0.05$  檢定

- (一) 不同骨材來源對試體強度之影響有無顯著之差異? 不同拌合廠對試體強度之影響有無顯著之差異?(12%)
- (二) 骨材來源與不同拌合廠有無交互作用?(8%)

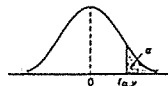
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表 A.1 標準常態分佈或然率表  $\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^x \exp(-\frac{1}{2}t^2) dt$

	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.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	.9279	.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
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

Critical values of the t-distribution

The following table contains critical values of t for given probability levels.



Degrees of Freedom, v	Probability alpha of a Larger Value				
	.1	.05	.025	.01	.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
30	1.310	1.697	2.042	2.457	2.750
40	1.303	1.684	2.021	2.423	2.704
60	1.296	1.671	2.000	2.390	2.660
120	1.290	1.661	1.984	2.358	2.626
∞	1.282	1.645	1.960	2.326	2.576

表 A.3  $\chi^2$  分佈,  $\alpha$ -百分率值 (取自 Brownlee, 1960)

$\alpha$	0.005	0.025	0.050	0.900	0.950	0.975	0.990	0.995	0.999
1	0.04393	0.03982	0.02393	2.71	3.84	5.02	6.03	7.88	10.8
2	0.0100	0.0500	0.103	4.61	5.99	7.38	9.21	10.6	13.8
3	0.0717	0.210	0.352	6.25	7.81	9.35	11.3	12.8	16.3
4	0.207	0.484	0.711	7.78	9.49	11.1	13.3	14.9	18.5
5	0.412	0.831	1.15	9.24	11.1	12.8	15.1	16.7	20.5
6	0.078	1.24	1.64	10.6	12.6	14.4	16.8	18.5	22.5
7	0.989	1.69	2.17	12.0	14.1	16.0	18.5	20.3	24.3
8	1.34	2.18	2.73	13.4	15.5	17.5	20.1	22.0	26.1
9	1.73	2.70	3.33	14.7	16.9	19.0	21.7	23.6	27.9
10	2.16	3.25	3.94	16.0	18.3	20.5	23.2	25.2	29.6
11	2.60	3.82	4.57	17.3	19.7	21.9	24.7	26.8	31.3
12	3.07	4.40	5.23	18.5	21.0	23.3	26.2	28.3	32.9
13	3.57	5.01	5.89	19.8	22.4	24.7	27.7	29.8	34.5
14	4.07	5.63	6.57	21.1	23.7	26.1	29.1	31.3	36.1
15	4.60	6.26	7.26	22.3	25.0	27.5	30.6	32.8	37.7
16	5.14	6.91	7.96	23.5	26.3	28.8	32.0	34.3	39.3
17	5.70	7.56	8.67	24.8	27.6	30.2	33.4	35.7	40.8
18	6.26	8.23	9.39	26.0	28.9	31.5	34.8	37.2	42.3
19	6.84	8.91	10.1	27.2	30.1	32.9	36.2	38.6	43.8
20	7.43	9.59	10.9	28.4	31.4	34.2	37.6	40.0	45.3
21	8.03	10.3	11.6	29.6	32.7	35.5	38.9	41.4	46.8
22	8.64	11.0	12.3	30.8	33.9	36.8	40.3	42.8	48.3
23	9.26	11.7	13.1	32.0	35.2	38.1	41.0	44.2	49.7
24	9.89	12.4	13.8	33.2	36.4	39.4	43.0	45.0	51.2
25	10.5	13.1	14.6	34.4	37.7	40.6	44.3	46.9	52.0
26	11.2	13.8	15.4	35.6	38.9	41.9	45.6	48.3	54.1
27	11.8	14.6	16.2	36.7	40.1	43.2	47.0	49.0	55.5
28	12.5	15.3	16.9	37.9	41.3	44.5	48.3	51.0	56.9
29	13.1	16.0	17.7	39.1	42.6	45.7	49.6	52.3	58.3
30	13.8	16.8	18.5	40.3	43.8	47.0	50.9	53.7	59.7
35	17.2	20.6	22.5	46.1	49.8	53.2	57.3	60.3	66.6
40	20.7	24.4	26.5	51.8	55.8	59.3	63.7	66.8	73.4
45	24.3	28.4	30.8	57.6	61.7	65.4	70.0	73.2	80.1
50	28.0	32.4	34.8	63.2	67.5	71.4	76.2	79.5	86.7
75	47.2	52.9	56.1	91.1	96.2	100.8	106.4	110.3	118.6
100	67.3	74.2	77.9	118.5	124.3	129.6	135.6	140.2	149.4