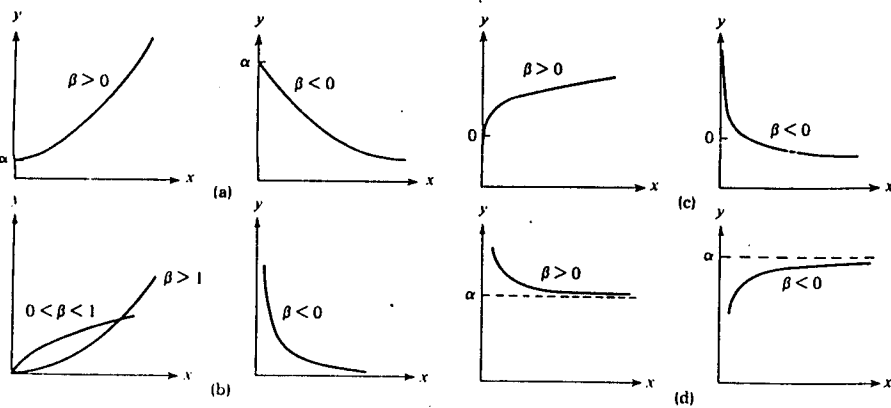


一. (20%) 下表所列為某受污染河川之 DO 值(依採樣順序排列), 請計算: (1) 平均值及標準差; (2) 99.9% 信賴區間。

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.11	1.17	1.79	5.62	1.13	1.54	3.19	1.73	2.09	2.75	1.20	1.01	1.64	1.57	1.54	2.09	3.54	1.17	1.15
20	21	22	23	24	25													
2.57	3.57	5.11	1.52	2.93	1.16													

二. (20%) 在許多環境工程之統計模型中, 非線性現象顯著, 但在統計迴歸過程中可加以線性化, 下圖顯示了四組環境數據分佈型態, 請寫出此四組非線性模型之迴歸方程, 並說明參數特性及線性化之方法。



三. (20%) 請解釋下列統計迴歸過程中之異常現象及解決方法:

- (1) multicollinearity
- (2) autocorrelation
- (3) dummy variable trap
- (4) heteroscedasticity

四. (20%) 下列兩組多項線性迴歸之結果顯示了廢棄物焚化爐煙道氣中戴奧辛(PCDD)和呋喃(PCDF)之濃度與操作溫度(TEMP)及一氧化碳(CO)濃度之線性關聯, 兩組數據各有 10 個採樣值, 迴歸係數下方括号中之數值為 t-ratio, 試以 R^2 及 t-ratio (5% level of significance) 加以討論, 並選出那一組迴歸結果較可靠。

$$(1) PCDD + PCDF = 2670.2 - 1.37 TEMP + 100.06 CO$$

(2.26) (-2.124) (1.871) $R^2 = 0.6727$

$$(2) PCDD + PCDF = 4754.6 - 5.14 TEMP + 103.41 CO$$

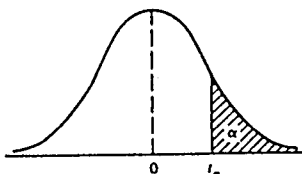
(0.629) (-3.763) (7.11) $R^2 = 0.9333$

五. (20%) 常態分佈之機率密度函數為:

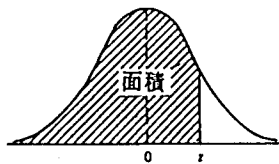
$$f(x) = \frac{1}{\sqrt{2\pi}\sigma^2} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

試推求: (1) Maximum likelihood estimator
 (2) Method of Moment estimator
 並就 "bias" 特性加以探討。

t 分配之臨界值



常態曲線之面積



v	alpha				
	0.10	0.05	0.025	0.01	0.005
1	3.078	6.314	12.706	31.821	63.657
2	1.888	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

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0011	0.0011
-2.9	0.0019	0.0018	0.0017	0.0017	0.0016	0.0016	0.0015	0.0015	0.0015	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0022	0.0021	0.0021	0.0021
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0031	0.0030	0.0029	0.0029	0.0028
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0038	0.0037
-2.5	0.0062	0.0060	0.0059	0.0057	0.0056	0.0054	0.0053	0.0052	0.0051	0.0050
-2.4	0.0082	0.0080	0.0078	0.0077	0.0075	0.0074	0.0072	0.0071	0.0070	0.0069
-2.3	0.0107	0.0104	0.0102	0.0101	0.0099	0.0098	0.0096	0.0095	0.0094	0.0093
-2.2	0.0139	0.0136	0.0133	0.0132	0.0129	0.0128	0.0126	0.0125	0.0124	0.0123
-2.1	0.0179	0.0174	0.0170	0.0168	0.0166	0.0164	0.0162	0.0161	0.0159	0.0158
-2.0	0.0228	0.0222	0.0217	0.0215	0.0212	0.0210	0.0208	0.0207	0.0205	0.0204
-1.9	0.0287	0.0281	0.0274	0.0272	0.0268	0.0266	0.0264	0.0262	0.0261	0.0259
-1.8	0.0359	0.0352	0.0344	0.0342	0.0337	0.0335	0.0332	0.0330	0.0328	0.0327
-1.7	0.0446	0.0438	0.0429	0.0427	0.0421	0.0419	0.0416	0.0414	0.0412	0.0411
-1.6	0.0548	0.0539	0.0529	0.0527	0.0520	0.0518	0.0515	0.0513	0.0511	0.0510
-1.5	0.0668	0.0658	0.0647	0.0645	0.0637	0.0634	0.0631	0.0628	0.0626	0.0625
-1.4	0.0808	0.0797	0.0785	0.0783	0.0774	0.0771	0.0768	0.0765	0.0763	0.0761
-1.3	0.0968	0.0956	0.0943	0.0941	0.0931	0.0928	0.0924	0.0921	0.0918	0.0916
-1.2	0.1151	0.1137	0.1123	0.1121	0.1109	0.1106	0.1103	0.1100	0.1097	0.1095
-1.1	0.1357	0.1341	0.1325	0.1323	0.1309	0.1306	0.1302	0.1299	0.1296	0.1294
-1.0	0.1587	0.1562	0.1539	0.1537	0.1513	0.1510	0.1505	0.1502	0.1499	0.1497
-0.9	0.1841	0.1814	0.1789	0.1787	0.1753	0.1750	0.1744	0.1741	0.1737	0.1735
-0.8	0.2119	0.2090	0.2064	0.2062	0.2019	0.2016	0.2009	0.2006	0.2002	0.1999
-0.7	0.2420	0.2389	0.2361	0.2359	0.2307	0.2304	0.2296	0.2293	0.2289	0.2286
-0.6	0.2743	0.2710	0.2680	0.2678	0.2617	0.2614	0.2605	0.2602	0.2598	0.2595
-0.5	0.3085	0.3050	0.3019	0.3017	0.2948	0.2944	0.2934	0.2931	0.2927	0.2924
-0.4	0.3446	0.3409	0.3372	0.3369	0.3290	0.3286	0.3275	0.3271	0.3267	0.3264
-0.3	0.3821	0.3783	0.3745	0.3742	0.3653	0.3649	0.3637	0.3633	0.3629	0.3625
-0.2	0.4207	0.4168	0.4129	0.4126	0.4029	0.4025	0.4012	0.4008	0.4004	0.4000
-0.1	0.4602	0.4562	0.4522	0.4519	0.4413	0.4409	0.4395	0.4391	0.4387	0.4383
0.0	0.5000	0.4960	0.4920	0.4917	0.4800	0.4796	0.4781	0.4777	0.4772	0.4768
0.1	0.5398	0.5357	0.5316	0.5313	0.5196	0.5191	0.5175	0.5171	0.5166	0.5162
0.2	0.5793	0.5751	0.5709	0.5706	0.5589	0.5583	0.5566	0.5562	0.5557	0.5552
0.3	0.6179	0.6135	0.6092	0.6089	0.5971	0.5964	0.5946	0.5942	0.5937	0.5932
0.4	0.6554	0.6509	0.6465	0.6462	0.6343	0.6336	0.6317	0.6313	0.6308	0.6303
0.5	0.6915	0.6869	0.6825	0.6822	0.6702	0.6695	0.6675	0.6671	0.6666	0.6661
0.6	0.7260	0.7213	0.7170	0.7167	0.7046	0.7039	0.7018	0.7014	0.7009	0.7004
0.7	0.7580	0.7532	0.7489	0.7486	0.7364	0.7357	0.7335	0.7331	0.7326	0.7321
0.8	0.7881	0.7832	0.7789	0.7786	0.7663	0.7656	0.7633	0.7629	0.7624	0.7619
0.9	0.8163	0.8113	0.8070	0.8067	0.7943	0.7936	0.7912	0.7908	0.7903	0.7898
1.0	0.8424	0.8373	0.8330	0.8327	0.8202	0.8195	0.8170	0.8166	0.8161	0.8156
1.1	0.8665	0.8613	0.8570	0.8567	0.8441	0.8434	0.8408	0.8404	0.8400	0.8395
1.2	0.8889	0.8836	0.8793	0.8790	0.8663	0.8656	0.8629	0.8625	0.8621	0.8616
1.3	0.9099	0.9045	0.9002	0.9000	0.8871	0.8864	0.8836	0.8832	0.8828	0.8823
1.4	0.9292	0.9237	0.9194	0.9192	0.9061	0.9054	0.9025	0.9021	0.9017	0.9012
1.5	0.9469	0.9413	0.9370	0.9368	0.9236	0.9229	0.9199	0.9195	0.9191	0.9186
1.6	0.9628	0.9571	0.9528	0.9526	0.9393	0.9386	0.9355	0.9351	0.9347	0.9342
1.7	0.9770	0.9712	0.9669	0.9667	0.9533	0.9526	0.9493	0.9489	0.9485	0.9480
1.8	0.9893	0.9834	0.9791	0.9789	0.9654	0.9647	0.9613	0.9609	0.9605	0.9600
1.9	0.9918	0.9858	0.9815	0.9813	0.9678	0.9671	0.9636	0.9632	0.9628	0.9623
2.0	0.9943	0.9882	0.9839	0.9837	0.9699	0.9692	0.9656	0.9652	0.9648	0.9643
2.1	0.9960	0.9898	0.9855	0.9853	0.9713	0.9706	0.9669	0.9665	0.9661	0.9656
2.2	0.9970	0.9907	0.9864	0.9862	0.9720	0.9713	0.9675	0.9671	0.9667	0.9662
2.3	0.9979	0.9915	0.9872	0.9870	0.9726	0.9719	0.9680	0.9676	0.9672	0.9667
2.4	0.9987	0.9922	0.9879	0.9877	0.9731	0.9724	0.9683	0.9679	0.9675	0.9670
2.5	0.9990	0.9925	0.9882	0.9880	0.9733	0.9726	0.9684	0.9680	0.9676	0.9671
2.6	0.9992	0.9927	0.9884	0.9882	0.9734	0.9727	0.9685	0.9681	0.9677	0.9672
2.7	0.9993	0.9928	0.9885	0.9883	0.9735	0.9728	0.9686	0.9682	0.9678	0.9673
2.8	0.9994	0.9929	0.9886	0.9884	0.9736	0.9729	0.9687	0.9683	0.9679	0.9674
2.9	0.9995	0.9930	0.9887	0.9885	0.9737	0.9730	0.9689	0.9685	0.9681	0.9676
3.0	0.9997	0.9931	0.9888	0.9886	0.9738	0.9731	0.9690	0.9686	0.9682	0.9677