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The Open University of Sri Lanka
B.Sc/B.Ed. DEGREE, CONTINUING EDUCATION PROGRAMME
No Book Test – 2023/2024
Level 05 - Applied Mathematics
ADU5305– Statistical Inference

Duration: - One Hour.

DATE: - 26-01-2024 **Time: -** [redacted] 2.30 - 3.30 p.m.

Non programmable calculators are permitted. Statistical tables are provided.

Answer all questions.

1.

(a) Briefly explain the following terms.
   (i) Point estimation and interval estimation
   (ii) Type I error and Type II error.

(b)

Suppose weight of a certain product *X*, produced by ABC Company, follows normal distribution. However, the mean weight and variance weight of randomly selected product is unknown.
Weights of 16 randomly selected products in grams are given below.

195.66	202.30	205.10	200.98	189.91
198.95	201.33	193.27	192.99	196.04
197.16	207.16	197.67	202.10	204.09
193.75				

(i) Find **95%** confidence interval for mean weight of a randomly selected product and interpret the results.

(ii) Find **90%** Confidence interval for variance weight of a randomly selected product and interpret the results.

2

Suppose we want to know whether or not the mean weight between two different species (***A and B***) of turtles is equal. 16 turtles from each population were randomly selected. The mean and variance weight of the turtles are given below. From the past experience it is reasonable to assume that the weights of the turtles of both spices follow normal distribution with equal variance.

Specie of turtle	**A**	**B**
Sample size	16	16
Sample mean	25.4 kg	27.8 kg
Sample standard deviation	1.5 kg	1.3 kg

(i) Using a suitable statistical test, test the validity of the claim that "weight of randomly select Spice B turtle is 29 kg". Use 5% level of significance.

(ii) Using suitable statistical test, test the validity of the claim that "randomly select Spice B turtle is heavier than the randomly select Spice A turtle". Use 5% level of significance.

Note: When the d.f > 20, t- distribution is approximated to standard normal distribution.

Table of Standard Normal Probabilities

Let $Z \sim N(0,1)$. This table contains the probabilities $Pr(Z \geq z)$

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183

TABLE B: t-DISTRIBUTION CRITICAL VALUES

	Tail probability p										
df	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
11	.697	.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	.695	.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	.694	.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	.692	.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	.691	.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	.690	.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	.689	.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965

Note: When the d.f > 20, t- distribution is approximated to standard normal distribution.

Table of $\chi^2_{\alpha,\nu}$ quantiles (χ^2 table)

df	α							
ν	0.99	0.975	0.95	0.90	0.1	0.05	0.025	0.01
10	2.558	3.247	3.94	4.865	15.987	18.307	20.483	23.209
11	3.053	3.816	4.575	5.578	17.275	19.675	21.92	24.725
12	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217
13	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688
14	4.66	5.629	6.571	7.79	21.064	23.685	26.119	29.141
15	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578
16	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32

Let $X \sim \chi^2_\nu$ and α be a probability. This table contains the upper α quantiles $\chi^2_{\alpha,\nu}$ of the χ^2_ν distributions such that $\Pr(X > \chi^2_{\alpha,\nu}) = \alpha$. For example, $\chi^2_{0.025,10} = 20.483$.