

Contents

Preface	vi	4	Some important probability distributions	43	
1	The role of statistics in decision making	1	4.1	Introduction	44
1.1	Introduction	2	4.2	Probability distributions of discrete random variables	44
1.2	The role of statistics in decision making	2	4.3	The binomial distribution	46
1.3	Basic principles and concepts of special studies	3	4.4	The Poisson distribution	48
1.4	Steps involved in planning and conducting special studies	3	4.5	The hypergeometric distribution	52
			4.6	Probability distributions of continuous random variables	53
			4.7	The normal distribution	55
				Review questions	62
2	Organizing and summarizing data	5	5	Some important sampling distributions	65
2.1	Introduction	6	5.2	Simple random sampling	66
2.2	Some basic vocabulary	6	5.3	Sampling distributions	67
2.3	Summarizing data: the ordered array	7	5.4	Distribution of the sample mean	68
2.4	Summarizing data: the frequency distribution	8	5.5	Distribution of the difference between two sample means	74
2.5	Summarizing data: the histogram and frequency polygon	11	5.6	Distribution of the sample proportion	75
2.6	Summarizing data: descriptive measures	12	5.7	Distribution of the difference between two sample proportions	77
2.7	Descriptive measures computed from grouped data	15		Review questions	79
	Review questions	19	6	Statistical inference I: estimation	84
3	Some elementary probability concepts	23	6.1	Introduction	85
3.1	Introduction	24	6.2	Properties of good estimators	85
3.2	Set concepts and notation (basic notions)	24	6.3	The population mean—known population variance	87
3.3	Counting techniques—permutations and combinations	30	6.4	The population mean—unknown population variance	92
3.4	Different views of probability	33	6.5	The difference between two population means—known population variances	97
3.5	Elementary properties of probability	34	6.6	The difference between two population means—unknown population variances	97
3.6	Calculating the probability of an event	35	6.7	The population proportion	99
3.7	Bayes' Theorem	37	6.8	The difference between two population proportions	101
	Review questions	38			

6.9	Determination of sample size for estimating means	102	8.3	Testing for significant differences between individual pairs of means	150
6.10	Determination of sample size for estimating proportions	104	8.4	The randomized complete block design	153
6.11	Confidence interval for the variance of a normally distributed population	106	8.5	The Latin square design	157
6.12	Ratio of the variances of two normally distributed populations	107	8.6	The factorial experiment	162
	Review questions	109		Review questions	166
7	Statistical inference II: hypothesis testing	113	9	Simple linear regression and correlation	174
7.1	Introduction	114	9.1	Introduction	175
7.2	Hypothesis testing—some general considerations	114	9.2	The simple linear regression model	175
7.3	The mean of a normally distributed population—known population variance	120	9.3	The assumptions underlying simple linear regression	176
7.4	The mean of a normally distributed population—unknown population variance	122	9.4	Obtaining the sample regression equation	177
7.5	The mean of a population that is not normally distributed	125	9.5	Evaluating the sample regression equation	178
7.6	The difference between the means of two normally distributed populations	128	9.6	Using the sample regression equation	183
7.7	The difference between the means of two populations not normally distributed	129	9.7	The correlation model	184
7.8	Testing a hypothesis about a population proportion	130	9.8	The correlation coefficient	185
7.9	The difference between two population proportions	132		Review questions	186
7.10	Testing a hypothesis about the variance of a normally distributed population	133	10	Multiple regression and correlation	193
7.11	The ratio of the variances of two normally distributed populations	134	10.1	Introduction	194
7.12	The type II error and the power of a test	135	10.2	The multiple-regression model and its underlying assumptions	194
7.13	Determining sample size to control both type I and type II errors	138	10.3	Obtaining the sample multiple-regression equation	195
	Review questions	140	10.4	Evaluating the regression equation	199
8	Analysis of variance	145	10.5	Using the sample multiple-regression equation	202
8.1	Introduction	146	10.6	The multiple-correlation model	204
8.2	The completely randomized design	147	10.7	Choosing the independent variables for the regression equation	206
				Review questions	206
			11	The chi-square distribution and the analysis of frequencies	214
			11.2	The mathematical properties of the chi-square distribution	215
			11.3	Tests of goodness of fit	215
			11.4	Tests of independence	220
			11.5	Tests of homogeneity	223
				Review questions	226

12	Nonparametric statistics	231	14	Elementary survey sampling	273
12.1	Introduction	232	14.1	Introduction	274
12.2	When to use nonparametric statistics	232	14.2	Applications	274
12.3	Measurement and measurement scales	233	14.3	Basic theory	274
12.4	Advantages and disadvantages of nonparametric statistics	233	14.4	Additional concepts	275
12.5	The one-sample runs test	234	14.5	Steps involved in a sample survey	276
12.6	The Wilcoxon signed-rank test for location	235	14.6	Stratified random sampling	276
12.7	The Mann-Whitney test	236	14.7	Cluster sampling	278
12.8	The sign test	238	14.8	Systematic sampling	280
12.9	The Kruskal-Wallis one-way analysis of variance by ranks	239	14.9	Costs, efficiency, and sample size	281
12.10	The Friedman two-way analysis of variance by ranks	240	14.10	Nonprobability sampling procedures	286
12.11	The Spearman rank correlation coefficient	242		Review questions	286
12.12	Nonparametric linear regression	244			
	Review questions	245	15	Statistical decision theory	290
13	Time-series analysis and index numbers	252	15.1	Introduction	291
13.1	Introduction	253	15.2	Some basic ideas	291
13.2	Secular trend	254	15.3	Application of the Bayes criterion	295
13.3	The moving average	257	15.4	Utility theory	296
13.4	Measuring seasonal variation	259	15.5	Bayesian decision theory and classical statistical inference	297
13.5	Measuring cyclical variation	263		Review questions	297
13.6	Forecasting	265	16	Some statistical applications in quality control	304
13.7	Index numbers	267	16.1	Introduction	305
13.8	Aggregative price indexes	268	16.2	Control charts—variables	305
	Review questions	270	16.3	Control charts—attributes	307
			16.4	Acceptance sampling for attributes	308
			16.5	Acceptance sampling by variables	309
				Review questions	310