

**STRUCTURE OF CURRICULUM**  
**FOR STATISTICS IN UNDERGRADUATE DEGREE PROGRAMME**

YEAR	PAPER No.	TITLE	WEEKLY TEACHING Hrs.	TOTAL TEACHING Hrs.
<b>FIRST</b>	THEORY PAPER – I	Descriptive Statistics and Probability Distributions	4	120
	PRACTICAL - I	---	3	90
<b>SECOND</b>	THEORY PAPER – II	Statistical Methods and Inference	4	120
	PRACTICAL - II	---	3	90
<b>THIRD</b>	THEORY PAPER - III	Applied Statistics	3	90
	PRACTICAL - III	---	3	90
	THEORY PAPER - IV	<b><u>ELECTIVES:</u></b> 1. Quality, Reliability and Operations Research 2. Bio-statistics 3. Actuarial Statistics 4. Programming in C	3	90
	PRACTICAL - IV	---	3	90

**B .A/B.Sc. III Year: Statistics Syllabus  
(With Mathematics Combination)**

**90 hrs**  
(3 hrs/ week)

**(Examination at the end of III Year)**

**Paper-III: APPLIED STATISTICS**

(with effect from 2010-2011)

**Unit – I**

**Design of Sample Surveys:**

Concepts of population, sample, sampling unit, parameter, statistic, sample frame and standard error.

Principal steps in sample surveys - need for sampling, census versus sample surveys, sampling and non- sampling errors, sources and treatment of non-sampling errors, advantages and limitations of sampling.

Types of sampling: Subjective, probability and mixed sampling methods. Methods of drawing random samples with and without replacement. Estimates of population mean, total, and proportion, their variances and the estimates of variances in the following methods.

- (i) SRSWR and SRSWOR
- (ii) Stratified random sampling with proportional and Neyman allocation, and
- (iii) Systematic sampling when  $N = nk$ .

Comparison of relative efficiencies. Advantages and disadvantages of above methods of sampling. **(23 L)**

**Unit – II**

**Analysis of Variance and Design of Experiments**

Concept of Gauss-Markoff linear model with examples, statement of Cochran's theorem, ANOVA – one-way, two-way classifications with one observation per cell Expectation of various sums of squares, Statistical I analysis, Importance and applications of design of experiments. Principles of experimentation, Analysis of Completely randomized Design (C.R.D), Randomized Block Design (R.B.D) and Latin Square Design (L.S.D) including one missing observation, expectation of various sum of squares. Comparison of the efficiencies of above designs.

**(23 L)**

**Unit – III**

**Time series:** -Time series and its components with illustrations, additive, multiplicative and mixed models. Determination of trend by least squares, moving average methods. Growth curves and their fitting with reference to Modified exponential, Gompertz and Logistic curves.

Determination of seasonal indices by Ratio to moving average, ratio to trend and link relative methods. **(12 L)**

**Index Numbers:** -Concept, construction, uses and limitations of simple and weighted index numbers. Laspeyer's, Paasche's and Fisher's index numbers, criterion of a good index numbers, problems involved in the construction of index numbers. Fisher's index as ideal index number. Fixed and chain base index numbers. Cost of living index numbers and wholesale price index numbers. Base shifting, splicing and deflation of index numbers. (6 L)

**Official Statistics:** - Functions and organization of CSO and NSSO. Agricultural Statistics, area and yield statistics. National Income and its computation, utility and difficulties in estimation of national income. (4 L)

#### Unit –IV

**Vital statistics:** Introduction, definition and uses of vital statistics. Sources of vital statistics, registration method and census method. Rates and ratios, Crude death rates, age specific death rate, standardized death rates, crude birth rate, age specific fertility rate, general fertility rate, total fertility rate. Measurement of population growth, crude rate of natural increase- Pearl's vital index. Gross reproductive rate and Net reproductive rate, Life tables, construction and uses of life tables and Abridged life tables. (12 L)

**Demand Analysis:** Introduction. Demand and supply, price elasticity of supply and demand. Methods of determining demand and supply curves, Leontief's, Pigou's methods of determining demand curve from time series data, limitations of these methods Pigou's method from time series data. Pareto law of income distribution curves of concentration. (10 L)

#### List of reference books:

1. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand
2. Parimal Mukhopadhyay : Applied Statistics . New Central Book agency.
3. Daroga Singh and Chowdhary: Theory and Analysis of Sample survey designs. Wiley Eastern.
4. M.R.Saluja : Indian Official Statistics. ISI publications.
5. B.L.Agarwal: Basic Statistics.New Age publications.
6. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.
7. Prathirupa Sidhanthamulu – Telugu Academy.
8. Prayoga Rachana and Visleshana – Telugu Academy.
13. K.V.S. Sarma: Statistics made simple : do it yourself on PC. PHI

14. Gerald Keller; Applied Statistics with Microsoft excel. Duxbury. Thomson Learning.
15. Levine, Stephan, Krehbiel, Berenson: Statistics for Managers using Microsoft Excel. Pearson Publication..
16. Anuvartita Sankhyaka sastram – Telugu Academy.
17. Arora, Sumeet Arora, S. Arora: Comprehensive Statistical Methods. S. Chand.
18. A. M. Goon, M. K. Gupta, B. Dasgupta Fundamentals of Statistics Vol II World Press Private Ltd., Calcutta
19. A. M. Goon, M. K. Gupta, B. Dasgupta An outline of Statistical Theory Vol II World Press Private Ltd., Calcutta 17.

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(With Mathematics Combination)  
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**90 hrs**  
(3 hrs/ week)

**Practical Paper – III  
(with effect from 2010-2011)**

**Sampling Techniques**

Estimation of population mean, population total and variance of these estimates by

1. Simple random sampling with and without replacement. Comparison between SRSWR and SRSWOR.
2. Stratified random sampling with proportional and optimum allocations. Comparison between proportional and optimum allocations with SRSWOR.
3. Systematic sampling with  $N=nk$ . Comparison of systematic sampling with Stratified and SRSWOR.

**Design of Experiments:**

4. ANOVA – one – way classification with equal number of observations
5. **ANOVA - one-way classification with equal number of observations using MS Excel.**
6. ANOVA Two-way classification with equal number of observations.
7. **ANOVA Two-way classification with equal number of observations using MS Excel**
8. Analysis of CRD. Analysis of RBD with and without missing observation
9. **Analysis of CRD. Analysis of RBD with and without missing observation using MS Excel**
10. Analysis of LSD with and without missing observation
11. **Analysis of LSD with and without missing observation using MS Excel.**
12. Comparison of relative efficiency of CRD with RBD and comparison of relative efficiencies of LSD with RBD and CRD.

**Time Series Analysis:**

13. Measurement of trend by methods of Least squares and moving averages
14. **Measurement of trend by methods of Least squares and moving averages using MS Excel.**
15. Determination of seasonal indices by methods of Ratio to moving averages, Ratio to trend and Link relatives.
16. **Determination of seasonal indices by methods of Ratio to moving averages, Ratio to trend and Link relatives using MS Excel.**

**Index Numbers:**

17. Computation of simple and all weighted index numbers.
18. Computation of reversal tests.

19. Construction of cost of living index number and wholesale index number.
20. Construction of fixed base and chain base index numbers.
21. Base shifting, Splicing and Deflation.
- 21(a). **Computation of all weighted indices, cost of living index number, Base shifting, splicing and deflation using MS Excel.**

**Vital Statistics:**

22. Computation of various Mortality rates, Fertility rates and Reproduction rates.
23. Construction of Life Tables and Abridged life tables.
24. **Construction of various rates, life tables and abridged life tables using MS Excel**

**Demand Analysis:**

25. Construction of Lorenz curve.
26. Fitting of Pareto law to an income data.
27. Construction of Lorenz curve using MS Excel.

**Note: Training shall be on establishing formulae in Excel cells and deriving the results. The excel output shall be exported to MSWord for writing inferences.**

**B .A/B.Sc. III Year: Statistics Syllabus  
(With Mathematics Combination)  
(Examination at the end of III Year)**

**90 hrs**  
(3 hrs/ week)

**Paper-IV: QUALITY, RELIABILITY AND OPERATIONS RESEARCH  
(with effect from 2010-2011)**

**(Elective – I)**

**Unit – I**

**Statistical Quality Control**

Importance of SQC in industry. Statistical basis of Shewart control charts. Construction of control charts for variables (mean, range and standard deviation) and attributes (  $p$  ,  $np$ , and  $c$ - charts with fixed and varying sample sizes). Interpretation of control charts.

Natural tolerance limits and specification limits, process capability index. Concept of Six sigma and its importance. **( 20 L )**

**Unit – II**

**Acceptance sampling plans:** Concept of AQL and LTPD. Producers risk and consumer's risk Single and Double sampling plans for attributes and their OC and ASN functions. Design of single and double sampling plans for attributes using Binomial and Poisson distributions

**Reliability:** Introduction. Hazard function, Exponential distribution as life model, its memory- less property. Reliability function and its estimation. System reliability - series, parallel and  $k$  out of  $N$  systems and their reliabilities. **(20 L)**

**Unit – III**

**Linear Programming:**

Meaning and scope of OR. Convex sets and their properties. Definition of general LPP. Formulation of LPP. Solution of LPP by graphical method. Fundamental theorem of LPP. Simplex algorithm. Concept of artificial variables. Big –M /Penalty method and two-phase simplex methods. Concept of degeneracy and resolving it, Concept of duality, duality as LPP. Dual Primal relationship. **(25 L)**

**Unit - IV**

**Transportation, Assignment and Sequencing Problems:**

Definition of transportation problem, TPP as a special case of LPP, Initial basic feasible solutions by North-West Corner Rule, Matrix minimum methods and VAM. Optimal solution through MODI tableau and stepping stone method for balanced and unbalanced transportation problem.

Degeneracy in TP and resolving it. Concept of Transshipment problem.

Formulation and description of Assignment problem and its variations. Assignment problem as special case of TP and LPP. Unbalanced assignment problem, traveling salesman problem. Optimal solution using Hungarian method.  
Problem of Sequencing. Optimal sequence of N jobs on two and three machines without passing. (25 L)

#### **List of reference books**

1. Kanti Swaroop,P.K.Gupta and ManMohan: Operations Research. Sultan Chand.
2. D.C.Montgomery: Introduction to Statistical Quality Control. Wiley
3. V.K.Kapoor and S.C.Gupta L Fundamentals of Applied Statistics. Sultan Chand
4. S.K.Sinha: Reliability and life testing. Wiley Eastern
- 5 L.S.Srinath: Reliability Engineering. Affiliated East-West Press.
6. Gass: Linear Programming. Mc Graw Hill.
7. Hadly : Linrar programming. Addison-Wesley.
- 8.Wayne L. Winston : Operations Research. Thomson, India edition. 4<sup>th</sup> edition.
9. S.M.Ross: Probability Models. Harcourt India PVT.Ltd.,
10. Parimal Mukhopadhyay : Applied Statistics . New Central Book agency
11. Anuvartita Sankhyaka sastram – Telugu Academy.
12. R.C.Gupta: Statistical Quality Control.
13. Taha : Operations Research: An Introduction : Mac Millan.
14. Parikriya Parishodhana - Telugu Academy.
- 15 A.M.Goon,M.K.Gupta,B.Dasgupta Fundamentals of Statistics Vol II World Press Private Ltd.,Calcutta
16. A.M.Goon,M.K.Gupta,B.Dasgupta An outline of Statistical Theory Vol II World Press Private Ltd.,Calcutta17.

**B.A/B.Sc. III Year: Statistics Syllabus**  
**(With Mathematics Combination)**  
**(Examination at the end of III Year)**  
**Practical Paper –IV**  
**(Elective – I)**  
**(with effect from 2010-2011)**

**90 hrs**  
(3 hrs/ week)

**Statistical Quality Control**

1. Construction of mean, range and standard deviation charts.
- 2. Construction of mean, range and standard deviation charts using MS Excel**
3. Construction of p, np and c- charts with fixed and varying sample sizes.
- 4. Construction of p, np and c- charts with fixed and varying sample sizes using MS Excel.**
5. Designing of Single sampling plan and Double sampling plan for attributes and construction of their OC and ASN curves
- 6 Construction of OC and ASN curves of Single sampling plan and Double sampling plan for attributes using MS Excel.**

**Reliability**

7. Computation of reliability for series, parallel and k out of n systems.

**Operations Research:**

8. Formulation and graphical solutions of LPP (using different inequality type constraints)
9. Solution of LPP by simplex method.
- 10. Solution of LPP by simplex method using TORA**
11. Solution of an LPP using Big-M and two phase simplex methods

**12.Solution of an LPP using Big-M method and two phase simplex method using TORA**

13.Initial Basic Feasible Solution of transportation problem using North-West corner rule, Matrix minimum methods and VAM

14. Optimum solution of transportation problem using North-West corner rule, Matrix minimum methods and VAM for IBFS using TORA

15.Optimum solution to balanced and unbalanced transportation problems by MODI method (both maximization and minimization cases).

16. Solution of balanced and unbalanced Assignment problem using Hungarian method (both maximization and minimization cases),

17. Solution of Assignment problem using Hungarian method (both maximization and minimization cases using TORA

18. Solution of traveling salesman problem.

19. Solution of sequencing problem—processing of  $n$  jobs through two machines and processing of  $n$  jobs through three machines.

**Note: Training shall be on establishing formulae in Excel cells and deriving the results. The excel output shall be exported to MSWord for writing inferences.**

**B .A/B.Sc. III Year : Statistics Syllabus  
(With Mathematics Combination)  
(Examination at the end of III Year)  
Paper-IV: BIO-STATISTICS  
(Elective – II) (with effect from 2010-2011)**

**90 hrs**  
(3 hrs/ week)

**Unit – I**

**Bioassay**

The purpose and structure of biological assay. Types of biological assays, Direct assays, Ratio estimates, asymptotic distributions: Feller's theorem. Regression approach to estimating dose-response, relationships, Logit and Probit approaches when dose-response curve for standard preparation is unknown, quantal responses, methods of estimation of parameters, estimation of extreme quantiles, dose allocation schemes, polychotomous quantal response, estimation of points on the quantal response function. (23 L)

**Unit – II**

**Statistical Genetics**

Basic terminology of genetics. Frequencies of genes and genotypes, Mendel's law, Hardy-Weinberg equilibrium. Mating Frequencies, estimation of allele frequency (dominant /co dominant cases). Multiple alleles. Approach to equilibrium for X-linked gene, natural selection, mutation, genetic drift, equilibrium when both natural selection and mutation are operative. (22 L)

**Unit – III**

**Survival Analysis**

Survival functions and hazard rates. Types of censoring and likelihood in these cases. Life distributions- Exponential, Gamma, Weibull, Lognormal, Pareto. Linear failure rate. Point estimation, confidence intervals, scores, likelihood ratio, MLE, tests for these distributions.

Life tables, failure rates, mean residual life and their elementary properties, Ageing classes and their properties, Bathtub failure rate. Estimation of survival function. Actuarial estimator, Kaplan-Meier estimator, estimation under the assumption of IFR/DFR. Tests of exponentiality against nonparametric classes, total time on test. (23 L)

**Unit – IV**

**Quantitative Epidemiology**

Introduction to modern epidemiology, principles of epidemiological investigation, surveillance and disease monitoring in populations.

Epidemiologic measures: Organizing and presenting epidemiologic data, measures of disease frequency, measures of effect and association, causation and casual inference. Design and analysis of epidemiologic studies. Types of studies, case-control studies, cohort studies, cross over design, regression models for the estimation of relative risk.

**List of reference books:**

- 1.D.J.Finney (1970): Statistical methods in Biological Assay. Charles Griffin.
- 2.Z.Govindarajulu (2000): Statistical Techniques in Bioassay. Karger Publishers/Panther Publishers.
- 3.C.C.Li (1976): First course in population genetics. Boxwood press, California.
4. Falcon and Mackay (1998) : Introduction to quantitative genetics. Longman
- 5.Cox.D.R. and Oakes.D (1984): analysis of survival data. Chapman and Hall.
- 6.Miller, R.G. (12981): Survival analysis. John wiley.
7. Anil gore and S.A.Paranjpe (2000). A course in mathematical and statistical ecology. Kulwer Academic Publishers.
8. Rielon E.C (1977): An introduction to Mathematical Ecology. Wiley.
9. J.F.Lawless: Statistical models and methods of life data. Wiley.
10. James F Crow and Motoo Kimura: An Introduction to Population Genetics Theory. Alpha edition.
- 11.Abraham M.Lilienfeld : Foundations of Epidemiology. Oxford University Press.

**B.A/B.Sc.IIIYEAR : Statistics Syllabus**  
**(With Mathematics Combination)**  
**(Examination at the end of III year)**  
**Practical Paper IV**  
**(Elective – II)**

**90 hrs**  
(3 hrs/ week)

1. Estimation of relative potency and its standard error.
2. Fitting exponential growth model to data by linearization method.
3. Fitting logistic growth model.
4. Dose response relation and its estimation by least squares method.
5. Dose response relation and estimation by MLE method.
6. Estimation of extreme quantiles.
7. Estimation of points on the quantal response.
8. Hardy –Weinberg equilibrium frequencies.
9. Estimation of allele frequencies.
10. Effects of mutation and selection.
11. Equilibrium—Balance between selection and mutation.
12. Selection and the Hardy -Weinberg test.
13. Genetic drift.
14. Parameter estimation in exponential and Weibull distributions—Type-I, Type-II censoring.
15. LR tests for exponential and Weibull distribution.
16. Actuarial method of estimation.
17. Kaplan-Meier estimator.
18. Total time on test.
19. Fitting bathtub shaped hazard function.
20. Measures of mortality.
21. Risk difference, risk ratio and odd ratio.
22. Cox Regression.

**The above practicals are to be carried out using MS Excel**

**Note: Training shall be in establishing formulae in Excel cells and derive the results. The excel output shall be exported to MS Word for writing inference.**

**B.A/B.Sc. III YEAR: Statistics Syllabus**  
**(With Mathematics Combination)**  
**(Examination at the end of III year)**  
**Paper IV: ACTUARIAL STATISTICS**  
**(Elective – III)**

**90 hrs**  
(3 hrs/ week)

**Unit –I.**

Utility theory, insurance and utility theory, models for individual claims and their sums, survival function, curate future lifetime, force of mortality.

Life table and its relation with survival function examples, assumptions of fractional ages, some analytical laws of mortality select and ultimate tables. **(20 L)**

**Unit – II**

Multiple life functions, joint life and last survivor status, insurance and annuity benefits through multiple life functions, evaluation for special mortality laws.

Multiple decrement models, deterministic and random survivorship groups, associated single decrement tables, central rates of multiple decrement, net single premiums and their numerical evaluations.

Distribution of aggregate claims, compound Poisson distribution and its applications. **(25 L)**

**Unit -III**

Elements of compound interest(nominal and effective rate of interest)

Life annuities: single payment, continuous life annuities, discrete life annuities, life annuities with monthly payments, communication functions, varying annuities, recursions and complete annuities- immediate and apportioable annuities –due.

**(25 L)**

**Unit - IV**

Net premiums: Continuous and discrete premiums, true monthly payment premiums, apportionate premiums, commutation functions, and accumulation type benefits.

Net premium reserves: continuous and discrete net premium reserve, reserves on a semi continuous basis, reserves based on true monthly premiums, reserves on an apportionable or accounted continuous basis reserves at fractional durations. **(20 L)**

### **List of Reference books:**

1. N.L.Bowers, H.U.Gerber, J.C.Hickman, D.A.Jones and C.J.Nesbitt (1986): Actuarial Mathematics, Society of Actuaries, Ithaca, Illinois,USA .
2. Neill,A.(1977): Life contingencies, Heineman.
3. Spurgeon E.T.(1972): Life contingencies, Cambridge University Press
4. Benjamin,B and Pollard,J.H(1980): Analysis of Mortality and other Actuarial Statistics.
5. Federation of Insurance Institutes study courses: mathematical basis of Life Assurance F.I.21 (Published by Federation of Insurance Institutes, Bombay).

**B.A/B.Sc.IIIYEAR: Statistics Syllabus  
(With Mathematics Combination)  
(Examination at the end of III year)  
Practical Paper IV  
(Elective – III)**

**90 hrs**  
(3 hrs/ week)

1. Computation of values of utility function.
2. Computation of various components of life tables.
3. Construction of multiple decrement table for deterministic survival group.
4. Determination of distribution function, survival function and force of mortality.
5. Construction of multiple decrement table for random survivorship group.
6. Construction of select, ultimate and aggregate mortality.
7. Calculation of p.d.f. and distribution function of aggregate claims.
8. Computation of compound interest (nominal and effective rate of interests).
9. Annuities and annuity dues.
10. Computation of discrete and continuous net premiums.
11. Annuities payable more frequently than one year.
12. Complete and special annuities.
13. Office premium a.
14. Assurances payable at the moment of death.

**B.A/B.Sc. III YEAR: Statistics Syllabus**  
**(With Mathematics Combination)**  
**(Examination at the end of III year)**  
**Paper IV: PROGRAMMING IN C**  
**(Elective – IV)**

**90 hrs**  
(3 hrs/ week)

**Unit – I**

History and features of C language. Components of C language, Structure of a C program. Data type; Basic data types, Enumerated data types, Derived data types. Variable declaration; Local, Global, Parametric variables, Assignment of variables. Numeric. Character, real and string constants. Arithmetic, relation and logical operators. Assignment operators. Increment and Decrement operators, conditional operators, Bitwise operators. Type modifiers and expressions, writing and interpreting expressions, using expressions in statements. Basic input/output. Control statements, conditional statements, if..else, Nesting of if..else, elseif ladder, switch statements, loops in C: for, while, do., while loops. Break, continue, exit( ), goto and label declarations **(23 L)**

**Unit - II**

One dimensional, two dimensional and multidimensional arrays. Functions, classification of functions, functions definition and declaration, assessing a function, return statement. Storage classes: Automatic variables, External variables, static variables, register variables, Scope and lifetime declarations. Parameter passing in functions, recursion in functions. Pointers: Pointer notation: and \*operators. Pointer declaration and Initialization, assessing a variable le through pointer, pointer expressions, pointer arithmetic, pointer comparison, pointer increment/decrement and scale factor. Pointer and Array: Pointers and one dimensional arrays, dynamic memory allocation functions malloc and calloc, pointers and multidimensional arrays, arrays of pointers. Pointers and functions: Pointers to pointers, pointers and functions, pointers to functions, Function returning pointers, functions with variable number of arguments. **(23 L)**

**Unit – III**

Structure: Definition and declaration, structure (initialization, comparison of structure variables, array of structures; array within structures, structures within structures. Passing structures to functions; structure pointers. Unions- definition and declaration, Accessing a union member, union of structure, initialization of a union variable, uses of union. Introduction to linked list, linear linked list insertion of a node on list, removal of anode from list. **(22 L)**

## **Unit - IV**

Files in C: Defining and opening a file, closing a file, input-output operation on file, Creating a file, reading a file.

Preprocessors: Introduction to preprocessors, Macro Substitution, simple Macro Substitution, Macro with arguments Nesting of Macros, Undefining a Macro, File inclusion, Conditional Compilation Directives. Standard header files, Library functions. String functions, Mathematical functions, Date and time functions, Variables argument list function, utility functions, character class test functions. **(22 L)**

### List of Reference Books:

1. Balagurusamy, E: Programming in ANSI C . Tata McGraw Hill.
2. Kanetkar, Y.P.: Working with C. BPB Publications.
3. Gottfried, Byron S: Theory and problems of programming with C, TMH
4. Schildt, Herbert: C : the complete reference . 3<sup>rd</sup> edition. TMH
5. Schildt, Herbert: C Made easy. McGraw Hill.

**B.A/B.Sc. III Year: Statistics Syllabus  
(With Mathematics Combination)  
(Examination at the end of III Year)  
Practical Paper –IV  
(Elective – IV)**

**90 hrs**  
(3 hrs/ week)

**C – Programming - List of Practical**

1. Reading and writing a line of text
2. Averaging student's examination Scores
3. Calculating standard deviation
4. Finding the median
5. Roots of a quadratic equation
6. Finding whether a given number is a prime or not
7. Searching for palindromes
8. Calculating factorial
9. Reading and writing the name Character by Character
10. Finding longest of a given set values
11. Generating Fibonacci numbers
12. Calculating the correlation coefficient
13. Printing a line of text backwards
14. Encoding a string of Characters
15. Concatenation of two strings
16. Transpose of a given matrix
17. Addition of two matrices
18. Multiplication of two matrices
19. Check whether the given matrix is an identity matrix
20. Creating a data file
21. Reading a data file
22. Creating an co unformatted file
23. Processing student's exam score defining a structure
24. Writing the output into a new data file
25. Appending a new record