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CUET · ECONOMICS · CLASS XI · CODE 309

Use of Statistical Tools

CUET unit: Statistics for Economics

By **UniDrill** · NCERT-grounded study material

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📌 Snapshot

- This **capstone topic** pulls together every tool from Chapters 1–7 (collection, organisation, tabulation, diagrams, central tendency, dispersion, correlation, index numbers) into a single applied workflow.
- A statistical project has **seven steps**: identifying the problem, choosing a target group, collecting data, organising/presenting it, analysing/interpreting it, drawing conclusions and citing a bibliography.
- A **sample project on toothpaste demand** illustrates the workflow — model questionnaire, frequency distributions, mean, standard deviation, bar/pie/histogram diagrams and observations.
- For CUET this topic is highly testable because its definitions and procedural steps are unambiguous and easy to frame as direct-recall MCQs.
- **Appendix A (Glossary)** is also fair game — short statistical definitions (Census, Random Sampling, Variable, Frequency, Class Mark, etc.) are often lifted verbatim into competitive MCQs.
- The integration of all previous chapters: kest102 (collection) → kest103 (organisation) → kest104 (presentation) → kest105 (central tendency) → kest106 (dispersion) → kest107 (correlation/index numbers) → kest108 (project).

📖 Detailed Notes

2.1 Core concepts

- **Purpose**: statistical tools studied in earlier chapters are used in daily life and in analysing economic activities such as production, consumption, distribution, banking, insurance, trade and transport (NCERT §1, p. 106).
- **Step 1 — Identifying a problem / area of study**: the student must be clear about the objective of the study before collecting data; examples include production/sale of a product (car, mobile phone, shoe polish, soap), water or electricity problems of a particular area, or consumer awareness about consumer rights (NCERT §1, p. 106).
- **Step 2 — Choice of target group**: the target group is chosen to suit the project; for cars the target is middle and higher income groups, for soap it is all rural and urban consumers, for safe drinking water it is both urban and rural population (NCERT §1, p. 107).

- **Step 3 — Collection of data**: the objective decides whether to use primary, secondary or both methods. Primary collection uses a questionnaire or interview schedule administered through personal interview, mailing/postal surveys, phone or email. A postal questionnaire must have a **covering letter** giving details about the purpose of inquiry (NCERT §1, p. 107).
- **Sampling vs census**: if sampling is used, care must be taken about suitability of the sampling method; secondary data may be used when there is paucity of time, money and manpower and the information is easily available (NCERT §1, p. 107).
- **Step 4 — Organisation and presentation of data**: after collection, data are organised and presented through tabulation and suitable diagrams (bar diagrams, pie diagrams etc.) — drawing on Chapters 3 and 4 (NCERT §1, p. 107).
- **Step 5 — Analysis and interpretation**: Measures of Central Tendency (e.g. mean), Measures of Dispersion (e.g. standard deviation) and Correlation are applied to calculate the average, variability and relationship among variables — drawing on Chapters 5 and 6 (NCERT §1, p. 108).
- **Step 6 — Conclusion**: meaningful conclusions are drawn after analysis; where possible the student must try to predict future prospects and offer suggestions on growth and government policies (NCERT §1, p. 108).
- **Step 7 — Bibliography**: the project must list details of all secondary sources (magazines, newspapers, research reports) used (NCERT §1, p. 108).
- **Suggested list of projects** (NCERT §2, pp. 108–109): twelve sample topics, including advisor to Transport Minister, village cottage-industry loan proposal, advertisement-effect study, literacy survey by a District Education Officer, overcharging survey by a Vigilance Officer, drinking water for a Gram Panchayat head, women's participation in employment schemes, health-and-sanitation survey by a Chief Health Officer, food-adulteration survey, polio-immunisation report, saving-habits survey by a Bank Officer, and farming-practices survey.
- **Sample project — toothpaste** (NCERT §3, pp. 109–113): young entrepreneur X wants to set up a toothpaste factory; the advisor decides to collect **primary data** through a questionnaire on six information needs — average monthly expenditure on toothpaste, brands currently in demand, customer attitudes, ingredient preferences, major media influences, and the relation between income and these factors.
- **Questionnaire content (p. 110)**: captures name, sex, ages and number of family members, monthly family income, urban/rural location, occupation of bread-winner, whether the family uses toothpaste, essential qualities of a good toothpaste, brand used, number of 100-gram packs per month, satisfaction, willingness to try a new toothpaste, desired features (plain, gel, antiseptic, flavoured, caries protection, fluoride), and main sources of information (cinema, exhibitions, internet, magazines, newspapers, radio, sales representatives, television).
- **Sample report findings** (NCERT §3, pp. 110–113): total sample size 100 households; 67% urban and 33% rural; majority of respondents aged 20–50; family

size mostly 3–6; **mean income ₹18,000 with SD ₹9,000**; **mean expenditure on toothpaste ₹104 per household per month with SD ₹35.60**; main occupations are service and trader; **Pepsodent, Colgate and Close-up** are the most preferred brands; selection basis is mainly standardised markings, quality, price and company brand name; **gel and antiseptic toothpastes** are preferred; **television** is the most influential medium (47 families), followed by newspaper (30), cinema (25), magazine (20), radio (18), sales representative (15) and exhibits-stall (10).

- **Recap (p. 113)**: the objective must be clearly identified, population and sample chosen carefully, the objective indicates the data type, a questionnaire/interview schedule is prepared, data are analysed using statistical tools, and results are interpreted to draw meaningful conclusions.
- **Appendix A — Glossary (pp. 114–116)**: short definitions of key terms — Analysis, Assumed Mean, Attribute, Bimodal / Bivariate Distribution, Census Method, Class Interval / Mark / Midpoint / Frequency, Continuous and Discrete Variable, Decile, Percentile, Frequency Array / Curve / Distribution, Inclusive and Exclusive Methods, Population, Questionnaire, Random Sampling, Range, Sample Survey, Sampling Error, Non-Sampling Error, Structured Questionnaire, Tally Marking, Time Series, Univariate Distribution, Variable, Weighted Average, Seasonality, Cyclicity, Statistics.
- **Appendix B (pp. 117–118)**: a published two-digit random-number table used to draw simple random samples without bias.
- **Why a capstone project chapter exists**: NCERT explicitly says students must "do, not just read"; theoretical mastery of mean, SD, correlation and indices is hollow without a real project where these tools are sequenced and applied to a single research question (NCERT §1, p. 106).
- **Why objective-first**: without a clearly framed question, data collection drifts and the resulting sample may not be informative. The objective dictates the **target population**, the **variables to measure**, the **sample size needed** and the **statistical tools** to deploy — making Step 1 the determinant of everything downstream (NCERT §1, p. 106).
- **Target-group matching examples (NCERT)**: for a car-market project the target is middle-and-upper-income households; for a soap project both rural and urban consumers; for safe drinking water the entire general population. The rule is: target group = the universe of agents whose behaviour the question concerns (NCERT §1, p. 107).
- **Primary vs secondary trade-off (NCERT §1, p. 107)**: primary data are tailor-made to the project but expensive and time-consuming; secondary data are cheap and quick but may not fit the question precisely. Most actual projects combine the two — primary for the specific behaviour of interest, secondary for the macro context.
- **Covering letter content**: name of investigator, sponsoring institution, purpose of the study, assurance of confidentiality, expected time for completion, and a reply-

paid return envelope. A poorly written covering letter is the single biggest determinant of low response rates in postal surveys (NCERT §1, p. 107).

- **Sampling-method suitability**: NCERT cautions that the sampling method must match the population structure — a stratified sample for a heterogeneous population (urban + rural), a simple random sample for a homogeneous one (NCERT §1, p. 107).
- **Step 4 in practice**: data are first **edited** (coded and cleaned for outliers and missing values), then **tabulated** (frequency tables, cross-tabs), and finally **diagrammed** (bar, pie, histogram). NCERT lays out tabulation and presentation as a single integrated step but in real projects editing comes first (NCERT §1, p. 107).
- **Step 5 statistical-tool choice**: mean for central tendency, standard deviation for dispersion, correlation if two variables are studied jointly; index numbers if comparing across time periods. NCERT explicitly cites mean and SD in the toothpaste illustration (NCERT §3, p. 111).
- **Step 6 conclusion principle**: conclusions must follow from the data and not from prior beliefs; predictions should be flagged as projections, not certainties; suggestions to policy should be grounded in the observed patterns. This discipline distinguishes a research report from an opinion piece (NCERT §1, p. 108).
- **Step 7 bibliography format**: author surname, initials, year, title (italicised), publisher, place — the standard academic format. Citing sources protects the project against plagiarism allegations and lets readers verify claims (NCERT §1, p. 108).
- **Toothpaste project — analytical findings**: mean monthly toothpaste expenditure ₹104 with SD ₹35.60 implies a coefficient of variation = (35.60/104) × 100 ≈ 34.2% — substantial relative dispersion suggesting that household toothpaste budgets are very heterogeneous, an insight directly relevant to the entrepreneur's pricing strategy (NCERT §3, p. 111).
- **Toothpaste project — income summary**: mean ₹18,000 with SD ₹9,000 gives CV = 50% — half the mean, indicating a very wide spread of household incomes in the sample. This high dispersion is itself an actionable insight, justifying market segmentation by price point (NCERT §3, p. 111).
- **Toothpaste project — implicit correlation**: NCERT's Step 5 hints at studying the relation between income and toothpaste expenditure — a Pearson's r computation that would test the standard hypothesis that toothpaste is a "necessity" (low income elasticity, low r) rather than a "luxury" (high income elasticity, high r) (NCERT §3, p. 109).
- **Sample-project sub-questionnaires (p. 110)**: items on essential qualities of a good toothpaste (whitening, fresh breath, gum protection, fluoride, taste) — directly relevant to ingredient choice; items on media exposure (TV, newspaper, cinema, radio) — directly relevant to advertising spend. Each survey item maps to a downstream business decision.

- **Toothpaste recap mnemonic**: "**I-T-C-O-P-A-C-B**" — Identify objective, Target group, Collect data, Organise, Present, Analyse, Conclude, Bibliography. Eight letters for the eight steps — a useful CUET MCQ recall aid.
- **Real-world projects vs textbook project**: NCERT's twelve sample project ideas (Transport Minister, Bank Officer, Vigilance Officer, Health Officer, etc.) are deliberately civil-service oriented — they prepare students for the policy-analysis posture that economists are expected to take (NCERT §2, pp. 108–109).

2.2 Definitions to memorise

Term	Definition	Page
Statistics	Method of collecting, organising, presenting and analysing data to draw meaningful conclusions; also means data itself	116
Census Method	Data collection method requiring observations on all individuals in a population	114
Sample Survey Method	Observations obtained on a representative subset (the sample) selected from the population	116
Random Sampling	Sampling in which every individual has an equal chance of being selected	116
Sampling Error	Numerical difference between the sample estimate and the true population value	116
Non-Sampling Error	Errors due to sampling bias, non-response and data-acquisition mistakes	115
Questionnaire	List of questions on the subject of enquiry to be answered by the respondent	116
Structured Questionnaire	Questionnaire of closed-ended questions with pre-specified options	116
Population	All individuals/units for whom information is sought	115
Informant	Individual/unit from whom information is obtained	115
Enumerator	Person who collects the data	115
Class Midpoint (Class Mark)	(Upper class limit + Lower class limit) ÷ 2	114
Range	Difference between maximum and minimum values of a variable	116
Seasonality	Periodicity in data variation with period less than one year	116
Cyclicity	Periodicity in data variation with period more than one year	114
Univariate distribution	Distribution involving a single variable	116
Bivariate distribution	Distribution involving two variables together	114

Term	Definition	Page
Weighted Average	Average computed after multiplying each value by an assigned weight	116
Tally Marking	Stroke method of counting frequency, grouped in fives	116
Frequency Array	Classification of a discrete variable showing frequency of each integral value	115
Frequency Distribution	Classification of values into classes with frequencies	115
Frequency Curve	Smooth curve through midpoints of frequency polygon	115
Inclusive Method	Both lower and upper limits belong to the same class	115
Exclusive Method	An item at the upper or lower limit is excluded from that class	115
Time Series	Series of observations arranged chronologically	116
Bibliography	List of all secondary sources used in the project	108

2.3 Diagrams / processes to remember

- **Fig. 8.1 (p. 110)**: bar diagram of age distribution of persons surveyed — Below 10, 10–20, 20–30, 30–40, 40–50, Above 50.
- **Fig. 8.2 (p. 110)**: bar diagram of family-size distribution (1–2, 3–4, 5–6, Above 6).
- **Fig. 8.3 (p. 111)**: histogram of monthly family income (classes 0–10,000; 10,000–20,000; 20,000–30,000; 30,000–40,000).
- **Fig. 8.4 (p. 112)**: pie diagram of major occupational status (Service, Professional, Manufacture, Trader, Any other).
- **Fig. 8.5 (p. 113)**: bar diagram on role of media — Television 47, Newspaper 30, Cinema 25, Magazine 20, Radio 18, Sales representative 15, Exhibits-stall 10.
- **Process flow**: Objective → Target group → Data collection (primary/secondary) → Organisation & tabulation → Diagrammatic presentation → Statistical analysis (mean, SD, correlation) → Interpretation → Conclusion → Bibliography (NCERT §1, pp. 106–108; Recap p. 113).
- **Frequency-distribution table for income (p. 110)**: uses an **assumed mean of ₹20,000** and step deviation $d' = (X - 20000)/5000$.
- **Frequency-distribution table for toothpaste expenditure (p. 111)**: uses an assumed mean of ₹100 and $d' = (X - 100)/40$.
- **Worked mean-and-SD numerical from project data**: suppose the 100 households have income classes 0–10000 (15 hh), 10000–20000 (35), 20000–30000 (30), 30000–40000 (20). Class marks 5000, 15000, 25000, 35000. Σfm = 75000 + 525000 + 750000 + 700000 = 2050000; mean = 2050000/100 = ₹20,500 (close to NCERT's ₹18,000 figure for the actual sample). For SD: Σfm^2 = 15·25,000,000 + 35·225,000,000 + 30·625,000,000 + 20·1,225,000,000 =

375,000,000 + 7,875,000,000 + 18,750,000,000 + 24,500,000,000 = 51,500,000,000; variance = (51,500,000,000/100) − (20,500)² = 515,000,000 − 420,250,000 = 94,750,000; SD ≈ √94,750,000 ≈ ₹9,734 (close to NCERT's ₹9,000). The arithmetic illustrates exactly how Steps 4 (organisation) and 5 (analysis) feed each other.

- **Worked CV computation**: for the toothpaste expenditure series (mean ₹104, SD ₹35.60), Coefficient of Variation = (SD/Mean) × 100 = (35.60/104) × 100 = 34.23%. For the income series (mean ₹18,000, SD ₹9,000), CV = 50%. The higher CV on income tells the entrepreneur that the income distribution is the more heterogeneous variable in this sample — a directly business-relevant statistical insight.
- **Worked pie-chart from project data**: occupations Service 35, Trader 28, Professional 15, Manufacture 12, Any-other 10 (total 100). Pie angles = 126°, 100.8°, 54°, 43.2°, 36° (sum 360°). Service dominates with more than a third of the pie — informing the entrepreneur which occupational group to target first.
- **End-to-end check**: in one project we have used questionnaire design (kest102), tabulation (kest103), pie/bar/histogram (kest104), mean (kest105), SD (kest106), and pricing-comparison logic that would use index numbers (kest107). The toothpaste case exercises every chapter — useful for a "which of the following is/are illustrated in the sample project" item.

2.5 Key formulas / process summary

Step	Output	NCERT page
Step 1 — Objective	Clear research question	106
Step 2 — Target group	Defined population to study	107
Step 3 — Data collection	Primary (questionnaire) or secondary (published) data	107
Step 4 — Organisation	Tabulated, classified data	107
Step 5 — Presentation	Bar/pie/histogram diagrams	107
Step 6 — Analysis	Mean, SD, correlation	108
Step 7 — Conclusion	Interpretation, predictions, suggestions	108
Step 8 — Bibliography	Citation of secondary sources	108
Mean (sample project)	₹18,000 income, ₹104 toothpaste expenditure	110–111
SD (sample project)	₹9,000 income, ₹35.60 toothpaste expenditure	110–111

2.4 Common confusions / NTA trap points

- **Sampling Error vs Non-Sampling Error**: numerical gap between sample estimate and true value vs errors from bias, non-response and acquisition mistakes.
- **Postal questionnaire must carry a covering letter** explaining the purpose of inquiry — a classic one-line MCQ.
- **Bibliography lists secondary sources**, not primary data.
- **Class Midpoint = Class Mark** — same thing, two names.
- **Seasonality vs Cyclicity**: seasonality is variation within one year; cyclicity is variation over more than one year.
- **Sample project numbers**: ₹104 ± ₹35.60 (toothpaste expenditure); ₹18,000 ± ₹9,000 (income). NTA swaps the two pairs.
- **Television is the dominant medium** (47 families), not newspaper.
- **Primary vs secondary data**: primary collected first-hand; secondary already published.
- **Steps are sequential**: identification before target group, target group before data, etc.
- **Random sampling glossary** definition matches the kest102 definition; both are interchangeable.
- **Appendix A is testable** — short verbatim definitions appear in CUET items.
- **The toothpaste project uses 100 households**, with 67% urban and 33% rural — not 50/50.

🎯 Practice MCQs

Q1. Which is the FIRST step in developing a statistical project?

A. Drawing meaningful conclusions

B. Identifying a problem or area of study

C. Preparing the bibliography

D. Choice of the target group

Q2. A primary-data questionnaire administered by post must be accompanied by:

A. Enumerator's identity card

B. Sample of secondary data

C. Covering letter giving details about the purpose of inquiry

D. Signed declaration from a government officer

Q3. In the sample toothpaste project, mean monthly expenditure per household and its SD were:

A. ₹18,000 and ₹9,000

B. ₹104 and ₹35.60

C. ₹100 and ₹40

D. ₹200 and ₹90

📊 PYQ Alignment

CUET Economics consistently picks one or two questions from this capstone chapter every year — most often direct-recall items on the **steps of a project** (target group, covering letter, primary vs secondary data), one definition from Appendix A (sampling error, random sampling, class mark, structured questionnaire), and at least one numerical-recall question from the **toothpaste sample report** (mean income ₹18,000 / mean expenditure ₹104 / television as the dominant medium). Assertion–Reason and match-the-following formats are increasingly common because the step-wise project structure lends itself naturally to those formats. See previous CUET PYQs on this chapter.