Notes on Review of Research and Quant Methods for AICP Exam

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Part II

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Data vs. Information vs. Intelligence

- **Data** – raw facts
- **Information** – organized data
- **Intelligence** – Interpreted information
- **Knowledge**
Paradigm/Conceptualization/Model

• **Paradigm** is a way of looking at things. Eg. Social conflict, feminist view, global view

• **Paradigm shift** – change in the way we look at things

• **Conceptualization** – Process of specifying of what we mean by certain terms/concepts. Eg. Prejudice, poverty

• **Operationalization** – specifying concrete empirical measures for concepts. Eg. Prejudice – attitude towards non-whites; Poverty - family income

• **Model** – Abstraction of ideas.
Deductive/Inductive Reasoning

• **Deductive** – From the general to the specific
• **Inductive** – From the particular to the general
• **Ecological Fallacy** – Conclusion drawn from the analysis of groups (e.g., companies) that are then applied to individuals (e.g., employees)
Information Source

• **Primary** – data gathered from original sources. E.g. Interviews, surveys, traffic counts.

• **Secondary** – published data often collected for other purposes. E.g. Census data.

• “Good” data – data with minimum bias or error.

• **Bias** is systematic error in a data set

• It is Important, particularly for secondary data, to know how data were collected. Eg., city boundary might have changed.
Data for Planning

• Major types of data for planning include:
  • population/demographic
  • economic
  • social
  • environmental

• Data could be qualitative or quantitative
  • Data Sources:
    NC State Data Center
  • SIC Code (Standard Industrial Classification Code)
  • NAICS (North American Industrial Classification Code)
Census Geography

- Census data are recorded by geographic areas that are arranged in a hierarchical order with the nation at the top and smaller areas at the base. Thus, we have US, regions, divisions, states, counties ..........block, etc.

- Identify major trends in census figures
- US Fact finder
- Cities that gained; those that lost.
- US urban and rural ratio: housing trends, ...
GIS

• It is a computer-based system for storage, analysis and display of spatial data.
• GIS is used as Planning Support system for decision making
• Maintenance of system important – Eg. Tracking building permits, updating business licenses.
• Read scale, identify characteristics.
Research Method

• **Purpose** – Exploration, description, explanation.

• **Unit** of analysis – Individual, groups, organizations

• **Time Frame** – Cross-section, longitudinal, panel,

• **Research** can be pure or applied.
  
  • Pure – Knowledge for the sake of knowledge
  
  • Applied – To put research into practice
Research Process

• Conceptualization – specifying what we mean when we use a particular term e.g., prejudice, delinquency
• Theory – Explanation about a phenomenon
• Hypothesis – A statement yet to be proven
• Method – field method, questionnaire survey
• Operationalization (Specifying a concrete meaning/variable) of the concept
• Data Collection / sampling
• Analysis
• Conclusion / implications
Reliability and Validity of Measurement

• **Reliability** – Whether a particular technique, applied repeatedly, would yield same result.

• **Validity** – The extent to which an empirical measure adequately reflects the “real meaning” of the concept under consideration.
Sampling

• Sampling is the technique of assigning portion of a population as representative of the entire population.

• The aim of sampling is to generalize the findings derived from the sample to the larger population from which the sample was selected. [N = population; n = Sample]

• Two types of sampling – Probability and non-probability
  • Probability sample allows you to measure the margin of sampling errors.
  • Non-probability does not allow
Types of Samples

Probability Sampling

• Random Sampling
• Stratified Random Sampling
• Systematic Sampling
• Cluster Sampling
Types of Samples (cont.)

Non-Probability Sampling

• Purposive Sampling
• Incidental (Available) Sampling
• Quota Sampling
• Judgment Sampling
• Convenience sampling
• Snowball sampling
Sample Size

**Sample Size** depends on desired reliability. Usually, larger n means more reliable/accurate estimates of population characteristics (e.g., income or attitude).

**Example**

What sample size would you use to survey a community of 5000 people about housing needs if you were willing to accept a 5% error.

\[
 n = \frac{N}{1+N(E)^2} 
\]

n = Sample; N = Population; E = Error term

\[
 n = \frac{5000}{1+5000(.05)^2} = \frac{5000}{13.5} = 370
\]
Date Classification

Levels of Measurement: Four types.

• Nominal Scale – Classify. e.g. Male – Female; Republican – Democrat – Independent; yes – no.

• Ordinal Scale – rank-order. e.g. good, better, worse; cold, colder, coldest.

• Interval Scale – rank order with values. e.g. temp. 99, 100, 1001.

• Ratio Scale – Numeric values. Numbers indicate actual amounts – e.g., 7,9,4.6
Variable

A characteristic which can have more than one value. The characteristics may be

• Qualitative or quantitative
• Dependent or independent
• Control variable
How to Present Data

Data display can be in different forms: What is the most appropriate form to represent data?

- Tabular Form – Tables.
- Graphic Form – Line, bar, pie-chart, etc.
- Maps
- Charts
- Should be able to read chart and interpret – negative vs. positive changes
Formulating Hypotheses

• Typically, a hypothesis states a relationship between two or more variables.

• The hypothesis can be a question, statement or null.
  
  Question: Is there a relationship between x and y? [e.g. Density and crime]
  
  Statement: There is a relationship between x and y.
  
  Null. There is no relationship between x and y.
  
  Alternative: There is/ is no relationship between ....
Testing a Hypothesis

• Null: there is no difference between traditional and modern methods of teaching

• Use a statistical test to find if there is a difference between the two methods.

• Type I and Type II errors:
  • Type I – Reject the null when it is in fact true
  • Type II – Accept a false hypothesis
Testing a Hypothesis (Cont.)

Null: There is no difference between traditional and modern methods of teaching
ALT: There is a difference

Data – Take a random sample of 25 from those subjected to traditional method of teaching. Compare their score with those subjected to modern method by calculating the mean and standard deviations of the scores. Suppose the mean value is 3.2 and the sd is 2.5.

Compute z-score. Say $Z$ is $1.67$ which is $0.0475$ on a z-table for a critical value of $0.05$

Conclusion: If we take a random sample of 25 students and teach them by traditional method, the probability is less than 5% that this sample will score 3.2 or higher, i.e., tie or beat the new method of teaching.
Statistics

Statistics deals with the theory and method of analyzing and interpreting data. The major types of statistics are:

- **Descriptive Statistics** – summarizes data. Data must be organized in such a manner that information can be easily used by the decision-maker.

- **Inferential Statistics** – Using data to draw conclusions from a sample about research questions or hypotheses.
Measures of Central Tendency

(Summarizes observation by a single measure)

• **Mean** – The arithmetic average of the scores.

• **Median** – Midpoint of all scores. Half the scores fall above the median and half below.
  Example: 5,7,8,9,12,13. What is the median?

• **Mode** – the most frequently occurring value in a data set. Example: 2,3,2,4,2,5. What is the mode?
Measures of Dispersion or Variability

- **Range** – The difference between the highest and lowest scores.

- **Variance** – Describes the extent to which scores differ from each other. $S^2 = \text{Sample Variance}; \sigma^2 = \text{Population Variance}.$

- **Standard Deviation** – Square root of the variance

- **Coefficient of Variation** – A measure that can be used for summarizing the degree of randomness. It is the ratio of the standard deviation over the mean.
Analysis of Relationships

- **Correlation** - measures relationships. Values can range from -1 to +1.

  -1 0 +1

- **Regression** - Used to estimate the value of one variable based on another variable. Dependent and independent variables used to determine relationship.
Central Tendency and Dispersion

Example

Suppose the test score of a sample of students in a class is as follows:

<table>
<thead>
<tr>
<th>Sample</th>
<th>$X_i$</th>
<th>$(x_i - \bar{x})$</th>
<th>$(x_i - \bar{x})^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>90</td>
<td>22</td>
<td>484</td>
</tr>
<tr>
<td>2</td>
<td>45</td>
<td>-23</td>
<td>529</td>
</tr>
<tr>
<td>3</td>
<td>65</td>
<td>-3</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>12</td>
<td>144</td>
</tr>
<tr>
<td>5</td>
<td>55</td>
<td>-13</td>
<td>169</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>7</td>
<td>49</td>
</tr>
</tbody>
</table>

$x_i = 410$  \hspace{1cm}  $\sum(x-x)^2 = 1384$

$x = \frac{x_i}{n} = \frac{410}{6} = 68.3$
Example (cont.)

\[ S^2 = \frac{1384}{5} = 276.8; \quad S = \sqrt{S^2} = 16.6 \]

\[ CV = \frac{S}{\bar{X}} = \frac{16.6}{68.3} = 0.25 \]

If we use the mean value to predict the score of an individual student, then the average percentage of error is as high as 25%.

Standard error of mean - analogous to standard deviation of many sample means.

\[ \sigma_{\bar{X}} = \frac{s}{\sqrt{N}} \]

\[ 16.6/ \sqrt{6} = 16.6/2.45 \]

\[ = 6.77 \]
Converting to Z-Scores (Standard score)

• We can use the values to describe the relative position of any observation in the sample. For example, an observation one standard deviation above the mean is $68.3 + 16.6 = 84.9$, $1\frac{1}{2}$ standard deviations above the mean is $68.3 + 24.9 = 93.2$. The same rule applies for values below the mean.

• In general, in normal distribution, 68.27 percent of the values lie between plus one or minus 1 sd, 95.45 percent lie between plus and minus 2 standard deviation.
Skewness and Symmetry of Distribution

- If distribution is symmetric, all three measures – mean, median and mode – are the same.

- If the distribution is highly skewed, you may want to use the median. Data may be positively or negatively skewed.
Normal Distribution

• Many variables in nature have distributions that look a lot like ND. Eg. height, age, weight, etc.

• The sample mean will approach the normal distribution as the sample size increases.
Skewness

**Normal Distribution**

- **Negative Skew**
  - Elongated tail at the left
  - More data in the left tail than would be expected in a normal distribution

- **Positive Skew**
  - Elongated tail at the right
  - More data in the right tail than would be expected in a normal distribution
Other Statistical Methods

• Chi-Square Test
• Correlation
• Regression
• Analysis of Variance (ANOVA)
• Non-Parametric Stats- lambda, tau, etc.
Population Projection

• Planners often use a variety of pop. forecasting models, both descriptive and complex math models.

• Determining the structure of pop is important, i.e., analysis of age, sex, geog. distribution, racial composition, etc.

• A good pop analysis should be concerned with size, composition and distribution of population.
Population Structure

• **Pop. Distribution** - shows the balance between pop and resources, facilities of a city/region. Distribution could be in terms of geographic distribution and density.

• **Population Pyramid** - Graphic representation of pop by age and sex.

• **Urbanization** - movement to the city has accelerated.

• **Migration** - the movement of people from one area to another. A number of "pull" and "push" factors play a role.

• **Vital Statistics** - a general term widely used by demographers in dealing with births, deaths, migration. Eg. Birth rate

• **Dependency Ratio** – Ratio of non-productive age group over productive age-group
Population Pyramid

- Birth rate
- Death rate
- Dependency ratio
- Population balance – M/F ratio
Stage 1 - expanding

High birth rate; rapid fall in each upward age group due to high death rates; short life expectancy.

Stage 2 - expanding

High birth rate; fall in death rate as more living in middle age; slightly longer life expectancy.

Stage 3 - stationary

Declining birth rate; low death rate; more people living to old age.

Stage 4 - contracting

Low birth rate; low death rate; higher dependency ratio; longer life expectancy

Source: Wikipdeia
Population Projection

- **Arithmetic** (linear) – Pop. grows or declines by nearly an equal amount
- **Geometric** (Exponential) – Pop increases at an increasing rate
- **Modified Exponential** – There is a maximum level where pop growth is constrained – Holding Capacity
- **Comparative** – Compares the study area with the pattern area
- **Regression** – Uses regression method
Pop Projection (Cont.)

Curve Fitting

1. Linear
2. Exponential
3. Modified Exponential
4. Comparative
Population Projection (Cont.)

• Cohort Survival Method

\[ P = \text{Birth} - \text{death} + \text{net migration} \]

Or

\[ P = B + S + M \]

\[ B = \text{Birth} \]

\[ S = \text{Survival} \]

\[ M = \text{Net migration} \]
Economic Base

• A method of examining the local economy so that we can have a better understanding of how a community earns its living.

• **Premise**: the growth of a community is principally determined by its status as an exporter to rest of the world.

• The theory divides the economy of a community into two:

  Basic - activities that cause funds to flow into a region.
  Non-basic - activities that support the basic industries in their efforts to expand and bring money into the region.

  Total Emp. = Emp in basic + Emp. in non-basic
Economic Base (cont.)

\[ e_t = e_b + e_{nb} \] \hspace{1cm} (1)

From Eq (1) we can derive the base ratio and the base multiplier.

Base ratio = \[ e_b / e_{nb} \] \hspace{1cm} (2)

Base multiplier = \[ e_t / e_b \] \hspace{1cm} (3)

Example: If the employment of a community is 16,000 and the basic employment is 4,000, then the base ratio is 1:3 and the base multiplier is 4

Base ratio = \[ 4000/12000 = 1:3 \]

Multiplier = \[ 16000/4000 = 4 \]
Multiplier

**Multiplier** - Captures the spin-off or ripple effects; used for forecasting. For instance, if basic employment increased by 1000, then total employment will increase by:

\[
\text{Change in Emp.} = \text{Base multiplier} \times \text{Change in Basic Emp.}
\]

\[
= 4 \times 1000 \\
= 4,000
\]
Defining Basic and Non-Basic Activities

• To define basic and non-basic activities, direct and indirect methods are suggested. Direct method includes surveying; indirect method (commonly used method) is LQ.

• **Location Quotient (LQ)** - a measure of the relative specialization of a region in a certain industry.

\[
LQ = \frac{e_i}{e_t} \div \frac{E_i}{E_t}
\]

LQ = Location quotient

\(e_i\) = Emp. in industry i in the region

\(e_t\) = Total Emp in the region

\(E_i\) = Emp in industry i in the nation

\(E_T\) = Total Emp in the nation
Location Quotient (cont.)

**Example:** If Emp. in agriculture in the region and the nation are 2500 and 40,000 respectively and total employment in the region and the nation are 45,000 and 800,000 respectively, then the

\[ LQ = 1.1112. \]

If \( LQ > 1.00 \), then the industry is basic

If \( LQ < 1.00 \), then the industry is nonbasic

If \( LQ = 1.00 \), then the region and the nation has an equal degree of specialization.
Minimum Requirement and Assumption Approach

• Minimum Req: Compares an industry's local employment pattern in a community to a set threshold based on similar-sized regions. Employment in excess of the threshold is then treated as export employment.

• Assumption App.: Assumes that certain industries (e.g., manufacturing, tourism, transfer payment,…) are basic and other sectors are non-basic.
Shift-Share

• Shift-share is a tool used to analyze the components of regional economic changes so that the forces behind the change can be identified.

• In shift-share the change in regional employment relative to change in national employment over a period of time can be viewed as the net of three effects:
  • the national share effect,
  • the industrial mix effect and
  • the regional share effect.
Shift-Share

• *National Share Effect*

  Measures the change in employment that should have occurred in a region if total employment had grown at the same rate as the national average.

• *Industrial-Mix Effect*

  Measures the distribution of regional employment among industries due to the differences in the industrial composition of the region and the nation.

• *Regional Share Effect*

  Measures the change due to differences in the growth rates of each industry in the region and the nation.
Cost-Benefit Analysis

**Definition**

- CBA applies to a range of evaluative methods which is used to make decisions about the use of society's scarce resources.

- Specific questions, which the method helps to address, are: Is a project or a program worthwhile? What is the optimal scale of operation?...etc.

- Some of the criteria used for evaluating projects include net present value (NPV), the benefit-cost ratio (B/C), internal rate of return (IRR).
CBA and Welfare Economics

• The rationale of CBA is found in the propositions of welfare economics. Welfare maximization
• (Pareto Optimality -- named after the 19th-century Italian social scientist) may be defined as a situation where a project is desirable if no body loses and at least one person gains.
• According to Pareto criteria, a project is desirable if no body loses and at least one person gains.
• Pareto optimality is expected to be achieved in a perfectly competitive market.
• Issues of competitive market being unrealistic
• Issues of public goods ... defense, street light... who pays?
Hicks-Kaldor

Pareto is restrictive. The test, "Is society better off?" is a tough test. You cannot find a project that does not hurt someone. So, use Hicks-Kaldor test, which is less restrictive.

H-K states that if those that are better off can compensate those that are worse off, then the project is worth undertaking.

Scitovsky Paradox – Price changes can reverse the compensation process. E.g.. At old price gainers may compensate losers; but at new price, the reverse may occur.
Cost Effectiveness

Cost Effectiveness - Useful when the effects of a project are difficult to assign a value. It helps to identify a preferred choice among a range of alternatives.

Eg. Health care --- reducing mortality rate, length of hospital stay
Benefit-cost ratio (B/C) is normally defined in terms of discounted values. The discounted values can be determined by using the net present value (NPV) method.

For example, if a project is expected to yield a benefit of worth $100 next year, we might value that $100 next year as $95 today.

The concept of present value is the reverse of the interest rate.

<table>
<thead>
<tr>
<th>Yr 0</th>
<th>Yr1</th>
<th>Yr2</th>
<th>Yr3</th>
<th>Yr4</th>
<th>Yr5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.00</td>
<td>$1.05</td>
<td>$1.1025</td>
<td>$1.1576</td>
<td>$1.2155</td>
<td>$1.2763</td>
</tr>
</tbody>
</table>

(at 5%)
Discounted Values

To convert the stream of future costs and benefits to present value, a rate of discounting future value must be selected -- example, 15%, 12%, 10 etc. The present value of an amount A due or available in n year at discount rate i can be computed as:

\[
\text{Present Value} = \frac{A}{(1+i)^n}
\]

For example, using a discount rate of 15 percent, a revenue of $400 in the 3rd year translates into a present value of

\[
\frac{400}{(1+.15)^3} = \frac{400}{(1.521)} = 263.
\]

Normally, the conversion to present value is done with the help of a table.
Example: An Irrigation Project (Table 1)

Suppose a dam is to be built over a period of two years for a total cost of $13.5 million. After that, there is an annual operation and maintenance cost. The life-span of the project is 7 years (to simplify the example), after which the dam will have a "salvage value" of $331,000.

The discounted benefits and costs are $17.4 million and $15.2 million respectively.

The C/B ratio = 1.14

The NPV = $17394 – 15217 = $2177
# Example Table 1

## Earth-Fill Dam Irrigation Project

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Cost</th>
<th>DF</th>
<th>Total Dis.</th>
<th>Benefit</th>
<th>DF</th>
<th>Total Dis.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7500</td>
<td>0.893</td>
<td>6698</td>
<td>0</td>
<td>0.893</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>6000</td>
<td>0.787</td>
<td>4782</td>
<td>0</td>
<td>0.787</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>1300</td>
<td>0.712</td>
<td>926</td>
<td>6000</td>
<td>0.712</td>
<td>4272</td>
</tr>
<tr>
<td>4</td>
<td>1300</td>
<td>0.636</td>
<td>827</td>
<td>6000</td>
<td>0.636</td>
<td>3816</td>
</tr>
<tr>
<td>5</td>
<td>1300</td>
<td>0.567</td>
<td>737</td>
<td>6000</td>
<td>0.567</td>
<td>3402</td>
</tr>
<tr>
<td>6</td>
<td>1300</td>
<td>0.507</td>
<td>659</td>
<td>6000</td>
<td>0.507</td>
<td>3042</td>
</tr>
<tr>
<td>7</td>
<td>1300</td>
<td>0.452</td>
<td>588</td>
<td>6000</td>
<td>0.452</td>
<td>2712</td>
</tr>
<tr>
<td></td>
<td>20000</td>
<td></td>
<td>15217</td>
<td>30331</td>
<td></td>
<td>17394</td>
</tr>
</tbody>
</table>

**B/C** = $\frac{17394}{15217} = 1.14$

**NPV** = $17394 - 15217 = 2177$
Internal Rate of Return (IRR)

IRR is that rate of discount \( (i) \) at which present value of benefits equals present values of costs or net present value is equal to zero. Said differently, IRR is the average earnings power of the money used in the project over the project life.

\[
\text{IRR} = \text{PV (benefit)} = \text{PV (cost)}
\]

or

\[
\text{PV} - \text{PC} = 0
\]
Issues and Problems in C/B Analysis (major ones)

• Use of sensitivity analysis because of uncertainty due to price changes, delays in implementing projects, cost overrun, etc.

• Which discount rate to use? Borrowing rate? Social opportunity cost?

• How to determine costs and benefits. What is the price of saving human life? What if the land used is unproductive (barren) land?

• The whole idea of making decision based on C/B. What about the employment capacity of a project? Equity factors? Distribution?
Efforts to Improve C/B

The Planning Balance Sheet (PBS) – developed by Lichfield. Recording costs and benefits regardless of unit of measurement. Where possible, assign monetary values, otherwise use weighing techniques.

The Goal Achievement Matrix (GAM) – developed by M. Hill - GAM assigns weights based on relative importance of goals and objectives identified by the community. The values are presented in a matrix form.
## Example Table 1

<table>
<thead>
<tr>
<th>Discounted Project</th>
<th>Benefit</th>
<th>Cost</th>
<th>NPV</th>
<th>B/C</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>600</td>
<td>400</td>
<td>200</td>
<td>1.5</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>325</td>
<td>350</td>
<td>-25</td>
<td>0.93</td>
<td>5</td>
</tr>
<tr>
<td>C</td>
<td>675</td>
<td>500</td>
<td>250</td>
<td>1.35</td>
<td>3</td>
</tr>
<tr>
<td>D</td>
<td>400</td>
<td>300</td>
<td>100</td>
<td>1.33</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>500</td>
<td>350</td>
<td>150</td>
<td>1.43</td>
<td>2</td>
</tr>
</tbody>
</table>

Which project would you recommend:

a. With budget constraint of $750?

b. With budget constraint of $850?

c. With no budget constraint?

d. With budget constraint of $750 and dependency? Project A is dependent on B.
Input Output Analysis (I/O)
(non-technical introduction)

• Useful in analyzing the structural interdependence among various sectors of the economy – agriculture, manufacturing, transportation, ...etc
• The I/O table has a transaction table or matrix that includes processing sector, final demand sector, payment sector, et.
• Technical coefficients can be computed from the transaction table
• I/O is useful in estimating the impact of change in one sector of the economy – Eg. Increase in agriculture or at a local level estimating the impact of a new plant coming into the town.
• Impacts are estimated as direct, indirect and induced impact.
Project Planning and Management

**Definition**

**Program Evaluation and Review Technique (PERT)** - An evaluation tool used to schedule a complex project composed of many interrelated tasks.

**PERT** is a visual interpretation of a series of interconnected tasks.

**Critical Path Method (CPM)** - A technique for discovering the most efficient ways to speed up a project
• **Activity** - a course of action to complete a task.

• **Gantt chart** – breaks down a project into its critical components and shows them in chronological order.  
  
  *Eg.* To survey homeless people: Prepare qr., recruit survey staff, conduct survey, analyze data, write report, etc.

• **Event** - the beginning and/or completion of an activity. It is represented by a circle.
Project Planning – Terms (Cont.)

• **Network Diagram** - a pictorial representation of the various events and activities of a project.

• **Slack time** - the time that an activity can be delayed without any delay in the completion of the whole project.

• **Standard deviation of a project** - a measure of the amount of deviation if the project were executed many times.
Project Planning (Cont.)

Steps

1. Define the tasks or activities.
2. Sequence the activities and draw a network diagram.
3. Get an estimate of the time required to complete each activity.
4. Calculate the mean expected time.
5. Use the mean expected time to draw the network diagram and determine the earliest allowable time to complete the project.
6. Determine the critical path. This is the path with the least slack time.
7. Calculate the standard deviation of the project.
<table>
<thead>
<tr>
<th>Activity</th>
<th>B</th>
<th>E</th>
<th>$t_o$</th>
<th>$t_m$</th>
<th>$t_p$</th>
<th>$t_e$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collect</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Clear</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Build</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Landscape</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>6</td>
</tr>
</tbody>
</table>

$T_L = 5$

---

**Diagram**

- **Nodes:** 1, 2, 3, 4
- **Activities:** Collect, Clear, Build, Landscape
- **Times:**
  - $T_L$: 0, 2, 2
  - $T_E$: 8
  - $t_e$: 3, 2, 6

**Network Diagram**

- **Edges:**
  - Collect to 2: $t_e = 3$
  - Build to 2: $t_e = 3$
  - Clear to 1: $t_e = 2$
  - Landscape to 3: $t_e = 6$
  - Collect to 4: $t_e = 8$
Budgeting

Taxes

• Legal foundations of taxes – statutes, laws, etc.
• Equity and fairness in taxes
• Types of taxes
  • Progressive
  • Regressive
  • Proportional
Budgeting (Cont).

Sources of Revenue

- Property tax – assessment, collection, problems
- Sales tax – problem and issues
- Income tax – what to tax?
- Miscellaneous sources – fees, special assessments, etc.
- Grants and aids
Budgeting (Cont.)

Budget Process

• Fiscal analysis and policy
• Expenditure estimates
• Revenue estimates
• Budget forecasting
• Review, adoption of budget
• Budget execution
Budgeting (Cont.)

Types of budgeting (Major types)

- Line Item
- Performance
- Zero-base
- Planning Programming and Budgeting System (PPBS)
- Dayton system
Budgeting (Cont.)

Capital Improvement Program (CIP)

- Multiyear scheduling and budgeting for public facilities
- Financing – bonds, reserve, special assessment, grants
- Administrative Process
Budgeting (Cont.)

Cost Revenue Studies

- Fiscal Impact analysis - assessment of revenue and cost associated with development, administrative change, etc. E.g. Annexation study

- Types
  - Per capita multiplier
  - Proportional valuation
  - Comparable city analysis
Planning Agency

• Functions & Responsibilities – plan preparation, project planning, policy analysis, public participation

• Organizational models – Under chief adm., independent commission, community development

• Internal Organization – by function, process, time frame, geog. Area

• Relationship to other agencies – Chief adm. Legislative body, Boards/Commissions, staff

• Agency Adm. Technical advisory, advocate
Planning Director (Role)

• Leader – Inspire, challenge, empower, ..
• Manager – Motivate, innovate, delegate, ...
• Technician – Knowledge/expertise, honesty, integrity, brevity, clarity...