Answer Key: Civil Engineering Licensure Exam – Mock Exam (Day 23: Cost-Benefit Analysis and Economic Feasibility Studies)

February 24, 2025

Answer Key

Section A: Multiple Choice Solutions

1. Objective of cost-benefit analysis: **(b) Compare benefits and costs to assess project feasibility**
2. Benefit-cost ratio formula: **(b)** $BCR = \frac{\textbf{Total Benefits}}{\textbf{Total Costs}}$
3. Economically feasible projects have a BCR: **(c) Greater than 1**
4. Payback period refers to: **(a) The time required to recover the initial investment**
5. Purpose of sensitivity analysis: **(a) Assess the impact of changes in key variables**

Section B: Problem-Solving Solutions

1. Benefit-Cost Ratio Calculation:

$$BCR = \frac{\sum \frac{B_t}{(1+i)^t}}{C_0}$$

$$= \frac{\sum \frac{120{,}000}{(1.08)^t} \text{ for } t = 1 \text{ to } 6}{500,000}$$

Using present value factor:

$$PV = 120,000 \times (4.6229) = 554,748$$

$$BCR = \frac{554,748}{500,000} = 1.11$$

Since BCR ¿ 1, the project is feasible.

2. Benefit-Cost Ratio for highway project:

$$BCR = \frac{1,500,000}{1,000,000} = 1.5$$

Since BCR ¿ 1, the project is feasible.

3. Payback period for hydropower plant:

$$\text{Payback Period} = \frac{\text{Initial Cost}}{\text{Annual Savings}}$$

$$= \frac{4,000,000}{500,000} = 8 \text{ years}$$

4. Net Present Value (NPV) for bridge project:

$$NPV = \sum \frac{B_t}{(1+i)^t} - C_0$$

$$= \sum \frac{300,000}{(1.06)^t} - 2,000,000$$

Using present value factor for 10 years:

$$PV = 300,000 \times 7.3601 = 2,208,030$$

$$NPV = 2,208,030 - 2,000,000 = 208,030$$

Since NPV ¿ 0, the project is feasible.

5. Sensitivity analysis on increased maintenance cost:

$$\text{New Cost} = \text{Original Cost} + 0.15 \times \text{Original Cost}$$

$$= 800,000 + 0.15(800,000) = 800,000 + 120,000 = 920,000$$