47 Practice Exam #2

47.1 A plant room contains a generator with a noise level of $95dBA$, an air compressor with a noise level of $88dBA$, and a pump with a noise level of $77dBA$. What is the overall noise level?

A. $87dB$

B. $95dB$

C. $96dB$

D. $98dB$

Refer to the table for Combining Two Sound Levels. Note that when the difference between the dB levels of two sources is between 5 and 9, the number of dB to be added to the highest source is $1dB$. Also recall that only two sources may be added at once; the table provides no guidance on adding more than two sources.

Start by combining the two loudest sources.

$$95dB + 1dB = 96dB$$

Regarding the pump noise, recognize that the difference between the noise levels between the pump and combined generator and compressor fall into the '$10dB$ or more' range, therefore, there is no meaningful difference to the combined level.

Answer C

47.2 A data center developer has a choice between (1) building a $50M data center that will have a 30 year lifespan and cost $1M per year to maintain, and (2) building a $15M data center that will have a 10 year lifespan and cost $3M per year to maintain. If the interest rate is 8%, which alternative is superior?

A. Option 1

B. Option 2

C. Neither, the options are comparable.

D. There is not enough information.

In engineering economics, when evaluating alternatives, there are two basic approaches: comparing the present value, and comparing the equivalent uniform annual cost (EUAC). When the two options have the same life cycle, present value is a viable option. However, when the two options have different life cycles as is the case here, EUAC is the preferred approach. The maintenance costs are given as annual costs already, so the main task is annualizing the up front cost. Write expressions for the EUAC for both options. Use the $i = 8\%$ Factor Table to retreive the cash flow factors.

$$EUAC_1 = \$50M\,(A/P, 8\%, 30) + \$1M = \$50M\,(0.0888) + \$1M = \$5.44M$$

$$EUAC_2 = \$15M\,(A/P, 8\%, 10) + \$3M = \$15M\,(0.1490) + \$3M = \$5.23M$$

Option 2 is superior.

Answer B

47.3 A company with a tax rate of 30% makes a $50,000 one time purchase that drives $8,000 of annual revenue and carries $1200 of annual maintenance costs. The salvage value after 10 years is $5000. What is the present value of the investment over 10 years at a 6% interest rate?

A. $-\$12,200$

B. $-\$6,000$

C. $\$11,700$

D. $\$52,800$

Draw a cash flow diagram or make a list of cash flows.

In Year 0, there is an initial payment of $50K (negative).

In Years 1-10, there is a net profit before tax of $\$8000 - \$1200 = \$6800$ and a net profit after tax of $\$6800\,(1 - 0.3) = \$4760$.

In Year 10, there is also a future payment for the salvage value of $5K in addition to the after-tax profit.

Note the tax rate is applied only to the annual profits and not to the initial cost or salvage value, and there is no reference to depreciation in the problem statement.

Write an expression for the present value. Use the $i = 6\%$ Factor Table to retreive the cash flow factors.

$$PV = -\$50,000 + \$4760\,(P/A, 6\%, 10) + \$5000\,(P/F, 6\%, 10)$$

$$PV = -\$50,000 + \$4760\,(7.3601) + \$5000\,(0.5584) = -\$12,174$$

Answer A