

**Instructions:**

*Please attempt every problem. You must support every solution with an appropriate amount of work and/or description. Unsupported answers may receive a score of 0. Good luck!*

1. (16 pts) Charlie has \$10,000 to invest for a period of 5 years. The following three alternatives are available to Charlie:

- Account I pays 4% for the 1st year, 6% for year 2, 8% for year 3, 10% for year 4, and 12% for year 5, all with annual compounding.
- Account II pays 12% for the 1st year, 10% for year 2, 8% for year 3, 6% for year 4, and 4% for year 5, all with annual compounding.
- Account III pays interest at the rate of 7.96294% per year for all 5 years.

Based on the available balance at the end of year 5, which alternative is Charlie's best choice?

**Solution:**

- Account I. The balance at the end of year 5 is

$$F_1 = 1000(1 + 0.12)(1 + 0.10)(1 + 0.08)(1 + 0.06)(1 + 0.04) = 14668.093.$$

+5

- Account II. The balance at the end of year 5 is

$$F_2 = 1000(1 + 0.04)(1 + 0.06)(1 + 0.08)(1 + 0.10)(1 + 0.12) = 14668.093.$$

+5

- Account III. The balance at the end of year 5 is

$$F_3 = 1000(1 + 0.0796294)^5 = 14668.088.$$

+5

Since  $F_1 = F_2 > F_3$ , Charlie's best choice can be either Account I or Account II

+1

2. (10 pts) Bailey, Inc., is considering buying a new gang punch that would allow circuit boards to be produced more efficiently. The punch has a first cost of \$100,000 and a useful life of 15 years. At the end of its useful life, the punch has no salvage value. Annual labor costs would increase \$2,000 using the gang punch, but annual raw material costs would decrease \$12,000. MARR is 5%/year. Should Bailey buy the gang punch?

Solution:

The annual saving is

$$12000 - 2000 = 10000$$

The present worth of the cash flows is

$$PW = -100000 + 10000 \left[ \frac{(1 + 0.05)^{15} - 1}{0.05(1 + 0.05)^{15}} \right] = 3796.581.$$

Since  $PW > 0$ , Bailey should buy the gang punch.

+10

3. (10 pts) Carlisle Company has been cited and must invest in equipment to reduce stack emissions or face EPA fines of \$18,500 per year. An emission reduction filter will cost \$75,000 and will have an expected life of 5 years. Carlisle's MARR is 10%/year. Is the filter economically justified?

Solution:

The annual saving is \$18500. The present worth of the cash flows is

$$PW = -75000 + 18500 \left[ \frac{(1 + 0.1)^5 - 1}{0.1(1 + 0.1)^5} \right] = -4870.445.$$

Since  $PW < 0$ , The filter is economically justified.

+10