Q1) Answer the following statement with true or false:

1. ---T---When interest is compounded annually, the amount of money accumulated in one year is the same under either a simple or compound interest scenario.
2. ---T---In solving from an unknown interest rate involving only the F/P formula, it is possible to solve for i directly by rearranging the equation.
3. ---T---Capitalized cost refers to the present value of infinite service.
4. ---T---When deposits are made into an account between compounding periods, those deposits do not begin to accrue interest until the next interest period begins.
5. ---F---A company's minimum attractive rate of return is generally equal to the rate of return obtainable on a bank savings account.
6. ---F---In calculating the present worth of an arithmetic gradient series, the only difference between an increasing and a decreasing gradient calculation is the minus sign for the base amount.
7. ---F---A nominal interest rate always has a compounding period equal to or less than a year.
8. ---F---The n value for an arithmetic gradient must always be expressed in years.
9. ---F---In a present worth comparison of alternatives with unequal lives, the study period to use should be equal to the life of the longer-lived alternative.
10. ---F---The present worth of a municipal bond is a function of the bond's face value, its dividend rate, the maturity date, and the interest rate in the market place.
11. ---F---When comparing unequal-life alternatives by the AW method, it is not necessary to compare them over their least common multiple of lives.
12. ---F---The capitalized cost of a finite-life alternative can be obtained by calculating its annual worth over one life cycle and than multiplying by the P/A factor for its life cycle.
13. ---T---It makes no difference in the final answer whether a rate of return equation is written in terms of P, A, or F.
14. ---F---When multiple rates of return are indicated for a cash flow series, it is necessary to have a reinvestment rate that is exactly equal to an i (that balances the ROR relation) in order to determine the unique composite rate of return i.
15. ---F---The interest rate used to perform a PW or AW evaluation of a public sector alternative is commonly lower than that used to evaluate a private sector project.
16. ---F---When alternatives are ranked on the basis of a present worth analysis, the same ranking will always be obtained with an annual worth or a project rate of return analysis.
17. ---T---Higher percentages of debt capital tend to increase the return on equity capital committed to a project.
18. ---F---The rate of return on the extra investment is interrupted as the percentage return on the amount invested in year 0 for the larger-initial investment alternative.
19. ---F---Sources of equity capital are stocks, bonds, and retaining earnings
20. It is absolutely essential that one of the multiple attributes used to evaluate an alternative is the PW or AW or ROR measure of worth.

Q2) Choose the most correct answer:

1. A quick, rough estimate of the time required for money to double can be obtained by dividing which of the following numbers by the compound interest rate?
   a. 100  b. 72  c. 64  d. 52

2. The amount of money five years ago that is equivalent to $1000 now at 10% per year compound interest is nearest to:
   a. $621  b. $667  c. $1500  d. $1611

3. All of the following are examples of cash inflows except:
   a. Income taxes  c. Asset salvage value
   b. Operating cost reduction  d. Construction cost savings

4. When the interest rate is 10% per year, all of the following are equivalent to $5,000 now except:
   a. $4,545 one year ago  c. $5,500 one year hence.
   b. $4,021 two years ago.  d. $6,050 two years hence.

5. The operating cost of a small machine is $800 in year one, $900 in year two, $1000 in year three, increasing by $100 per year through year ten. At an interest rate of 8% per year, the equivalent annual worth of the machine is nearest to:
   a. $1187  b. $2598  c. $1149  d. $7966

6. A young couple wishing to save money for their child's first year in college purchases an insurance policy that will yield $10,000 fifteen years from now. The cost of the policy is $500 per year for 15 years, beginning one year from now. The rate of return on their investment is nearest to:
   a. 3%  b. 4%  c. 5%  d. 6%

7. The length of time required for money to quadruple in value at an interest rate of 6% per year is nearest to:
   a. 12 years  b. 18 years  c. 24 years  d. 30 years

8. At an interest rate of 10% per year, expenditures of $1,000 in years zero, three and six could be replaced by a single investment in year eight nearest to:
   a. $3621  b. $4964  c. $3964  d. $5721

9. An interest rate of 1% per month is the same as:
   a. Nominal 3% per quarter compounded monthly.
   b. Effective 12.683% per year compounded monthly.
   c. Nominal 12% per year compounded monthly.
   d. All of the above.

10. An interest rate of 12% per year compounded continuously is the same as:
    a. Nominal 1% per month compounded continuously
    b. Effective 1.08% per month compounded continuously
    c. Effective 12.683% per year compounded continuously
    d. None of the above.
11. If you deposit $1000 per month into an account which pays interest at a rate of 12% per year compounded monthly, the amount of money you would have at the end of five years is nearest to:
   a. $6353  
   b. $68321  
   c. $76234  
   d. $81670

12. Income from a certain operation is expected to be zero in years one through five, after which it will be $50,000 per year forever. The capitalized cost of the income at 10% per year is nearest to:
   a. $252300  
   b. $282250  
   c. $310450  
   d. $500000

13. Interest payments on a bond are $300 every six months. If the face value of the bond is $10,000, the bond interest rate is:
   a. 3% per year  
   b. 3% per year compounded semiannually  
   c. 6% per year compounded semiannually  
   d. 12% per year compounded quarterly

14. In comparing different-life alternatives by the annual worth method, an assumption inherent in using annual worth values for one life cycle is:
   a. All of the costs associated with each asset remain the same in succeeding life cycles.  
   b. The alternatives will be needed for an indefinite period of time.  
   c. The alternatives will be needed only through the life of the shorter-life alternative.  
   d. The costs of the alternatives will change only by the inflation or deflation rate.

15. A permanent historic monument has a first cost of $20,000 with a maintenance cost of $2,000 every three years. At an interest rate of 10% per year, the annual worth of the monument is nearest to:
   a. $2604  
   b. $4000  
   c. $4606  
   d. $6710

16. For the equation: $5000 = 1000(P/F, i,1) - 2000(P/F, i,2) + 7000(P/F, i,7) + 7000(P/F, i,9)$, the number of possible rate of return values is:
   a. 1  
   b. 2  
   c. 3  
   d. 4

17. In calculating a composite or external rate or return for a given cash flow sequence, if the reinvestment interest rate is greater than the internal rate of return, the resulting rate of return will be:
   a. Lower than the internal rate of return  
   b. Greater than the internal rate of return  
   c. Greater than the reinvestment interest rate  
   d. Equal to the difference between the internal rate of return and the reinvestment interest rate

18. If an investment triples in value in seven years, the rate of return on the investment is nearest to:
   a. 6%  
   b. 17%  
   c. 25%  
   d. 35%

19. In an incremental investment rate of return analysis of multiple mutually exclusive alternatives that have different lives, the incremental investment cash flow must extend through:
   a. The life of the longer of the two alternatives under consideration  
   b. The least common multiple of the lives of the two alternatives under consideration  
   c. The longest life of all of the alternatives under consideration  
   d. The least common multiple of the lives of all of the alternatives under consideration
20. The difference between a modified B/C ratio and a conventional B/C ratio is that the modified ratio:
   a. Subtracts M&O (maintenance and operating) costs from the numerator
   b. Places M&O costs in the denominator
   c. Places M&O costs in the numerator and disbenefits in the denominator
   d. Places disbenefits and M&O costs in the denominator

21. The initial cost of a federal highway project is $4 million. The road will require maintenance at a cost of $50,000 per year during its 20 year life. If benefits of $300,000 per year have been identified, the B/C value at an interest rate of 6% per year is closest to:
   a. 0.75
   b. 0.91
   c. 1
   d. 1.36

22. A water conservation project funded by the federal government will have an initial cost (year 0) of $1 million and an upgrade cost of $300,000 in year five. The annual operating costs are expected to be $100,000. The water saved is valued at $200,000 in years one through four, and $50,000 each year thereafter through the 10 year life of the project. If the water saved is considered to be a benefit to the people, the B/C ratio at an interest rate of 6% per year is closest to:
   a. 0.45
   b. 0.59
   c. 0.93
   d. 1.18

Q3) A start-up internet service provider expects to lose money in each of the first four years. Losses are projected to be $50 million in year one, $40 million in year two, $30 million in year three and $5 million in year four. An interest rate of 10% per year is used.

   a. The present worth of the losses for the first three years is nearest to:

   \[
   \text{Coding in million of dollars and using } G = -10
   \]

   \[
   P = 50(P/A, 10\%, 3) + 10(P/G, 10\%, 3)
   \]

   \[
   = 50(2.4869) + 10(2.3291)
   \]

   \[
   = 101.054 \text{ million}
   \]

   b. The present worth of the losses for all four years is nearest to:

   \[
   P = 50(P/A, 10\%, 3) + 10(P/G, 10\%, 3) + 5(P/F, 10\%, 4)
   \]

   \[
   = 50(2.4869) + 10(2.3291) + 5(0.6830)
   \]

   \[
   = 104.469 \text{ million}
   \]

   c. The equivalent uniform annual worth of the losses through year four is nearest to:

   \[
   P = 50(P/A, 10\%, 3) + 10(P/G, 10\%, 3) + 5(P/F, 10\%, 4)
   \]

   \[
   = 50(2.4869) + 10(2.3291) + 5(0.6830)
   \]

   \[
   = 104.469 \text{ million}
   \]

   \[
   A = P(A/P, 10\%, 4)
   \]

   \[
   = 104.469(0.31547)
   \]

   \[
   = 32.957 \text{ million}
   \]

   d. In order to recover the losses by the end of year nine, the company's equivalent uniform annual profit in years five through nine must be nearest to:

   \[
   P = 50(P/A, 10\%, 3) + 10(P/G, 10\%, 3) + 5(P/F, 10\%, 4)
   \]

   \[
   = 50(2.4869) + 10(2.3291) + 5(0.6830)
   \]

   \[
   = 104.469 \text{ million}
   \]
\[
F10 = 104.469(F/P, 10\%, 10) \\
= 104.469(2.5937) \\
= $270.961 \text{ million}
\]

\[
A = 270.961(A/F, 10\%, 5) \\
= 270.961(0.1638) \\
= $44.383 \text{ million}
\]

**Q4)** The data for new and used machines are shown below:

<table>
<thead>
<tr>
<th></th>
<th>Used machine</th>
<th>New machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial cost($)</td>
<td>15,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Annual operating cost ($/year)</td>
<td>8,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Salvage value ($)</td>
<td>5,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Life (years)</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

Use an interest rate of 10% per year.

a. The present worth of the new machine is closest to: **$43066**

b. To compare the machines on the basis of a present worth analysis, the present worth values to use are:

- Must compare over least common multiple (LCM) of 6 years.
- \(PW_{\text{used}} = 15,000 + 8000(P/A, 10\%, 6) - 5000(P/F, 10\%, 3) + 15,000(P/F, 10\%, 3) - 5000(P/F, 10\%, 6)\)
- \(PW_{\text{new}} = 40,000 + 2000(P/A, 10\%, 6) - 10,000(P/F, 10\%, 6)\)
- \(PW_{\text{used}} = 15,000(0.40211) + 8,000 - 5,000(0.30211)\)
- \(PW_{\text{new}} = 40,000 + 2000(0.40211) - 10,000(0.30211)\)
- \(PW_{\text{used}} = 12,521\)
- \(PW_{\text{new}} = 43,066\)

The capitalized cost of the used machine is nearest to:

\[
A = 15,000(A/P, 10\%, 3) + 8,000 - 5,000(A/F, 10\%, 3) \\
= 15,000(0.40211) + 8,000 - 5,000(0.30211) \\
= $12,521
\]

\[
P_{\text{cap}} = 12,521/0.10 \\
= $125,211
\]

**Q5)** Two stamping machines are under consideration for purchase by a metal recycling company. The manual model will cost $25,000 to buy with an eight-year life and a $5,000 salvage value. Its annual operating costs will be $16,000. A computer-controlled model will cost $95,000 to buy and it will have a twelve-year life if upgraded at the end of year six for $15,000. Its terminal salvage value will be $23,000, with annual operating costs of $7,500 for labor and $2,500 for maintenance. The company's minimum attractive rate of return is 18%. Determine:

a. The annual worth of the computer-controlled machine is nearest to:

\[
A = 95,000(A/P, 18\%, 12) + 10,000 + 15,000(P/F, 18\%, 6)(A/P, 18\%, 12) - 23,000(A/F, 18\%, 12) \\
= 95,000(0.20863) + 10,000 + 15,000(0.3704)(0.20863) - 23,000(0.02863) \\
= $30,320
\]

b. The perpetual equivalent annual worth of the manual model is nearest to
Perpetual annual worth is equal to A for one life cycle:

\[ A = 25,000 \frac{A}{P, 18\%, 8} + 16,000 - 5,000(\frac{A}{F, 18\%, 8}) \]
\[ = 25,000(0.24524) + 16,000 - 5,000(0.06524) \]
\[ = \$21,804.80 \]

Q6) A wealthy alumna of a small university wanted to establish a permanent endowment in her name that would provide scholarships of $10,000 per year starting 20 years from now. If the university can invest money at an interest rate of 8% per year, determine the amount of money that must be donated now.

\[ P_{19} = \frac{10,000}{0.08} \]
\[ = \$125,000 \]

\[ P_0 = 125,000(P/F, 8\%, 19) \]
\[ = 125,000(0.2317) \]
\[ = \$28,962.50 \]

Q7) It costs $1000 for hand tools and $1.50 labor per unit to manufacture a product. Another alternative is to manufacture the product by an automated process that costs $15,000, with a $0.50 per-unit cost. With an annual production rate of 5000 units, how long will it take to reach the break-even point?

Cumulative cost (hand tools) = $1000 + $1.50x, where x is the number of units.
Cumulative cost (automated) = $15,000 + $0.50x
Set cumulative costs equal and solve for x.
\[ $1000 + $1.50x = $15,000 + $0.50x \]
\[ $1x = $14,000 \]
\[ x = 14,000 \text{ units} \]
\[ t_{\text{break-even}} = \frac{x}{\text{production rate}} = \frac{14,000}{5000} = 2.8 \text{ yr} \]