

## MIDTERM EXAM 1-Solution

1. (2 points) The essence of the time value of money is that a future dollar is worth more than a present dollar.

TRUE      FALSE

2. (2 points) When using the (F/A) factor, the equivalent future worth is located one period prior to the last A.

TRUE      FALSE

3. (2 points)  $(P/G, i, 2) = (P/F, i, 2)$

TRUE      FALSE

4. (2 points) An interest rate of 3% per quarter compounded monthly is a nominal rate.

TRUE      FALSE

5. (2 points) An interest rate of 1.5% per month compounded continuously is the same as 4.5% per quarter compounded continuously.

TRUE      FALSE

6. (2 points)  $(F/A, i, n) * (P/F, i, n) * (A/P, i, n) =$                      1                    

7. (4 points) Which statement(s) should be true, if the nominal interest rate is 12% per year, compounded quarterly?

- a. Effective interest rate  $i = 1\%$  per month
- b. Effective interest rate  $i = 3\%$  per quarter
- c. Nominal interest rate  $r = 6\%$  semiannually, compounded quarterly
- d. Nominal interest rate  $r = 4\%$  per quarter, compounded monthly

8. (4 points) The equivalent annual worth A over years 1-10 of the cash flow below is given by which one(s) of the following?

Year	0	1	2	3	4	5	6	7	8	9	10
Amount	0	0	0	50	100	150	200	250	300	350	400

- a.  $A = 50(A/G, i, 8) (F/P, i, 9)(A/F, i, 10)$
- b.  $A = 50(P/G, i, 9) (P/F, i, 1)(A/P, i, 10)$
- c.  $A = 50(P/G, i, 8)(P/F, i, 1)(A/P, i, 10)$
- d.  $A = 50(A/G, i, 9)(F/A, i, 9)(A/F, i, 10)$

9. (20 points) Ben sets up a saving account and deposits \$2000 every quarter for 6 years
- a. (10 points) If the account earns interest at a rate of 12% per year compounded quarterly, how much money will be in a saving account at the end of 6 years?

PP= quarter, CP=quarter, PP=CP  
 N=24 quarters  
 Effective rate  $i$  per quarter =  $12\%/4 = 3\%$

$$F = 2000(F/A, 3\%, 24) = 68852.94$$

- b. (10 points) If the account earns interest at a rate of 12% per year compounded semiannually, how much money will be in a saving account at the end of 6 years?

PP= quarter, CP=6 months, PP<CP  
 Move deposits to the end of CP, and find F

$$F = 4000(F/A, 6\%, 12) = 4000 * 16.870 = 67479.76$$

10. (20 points) For the cash flows shown, calculate the annual worth (years 1 through 5). Use an interest rate of 10% per year.

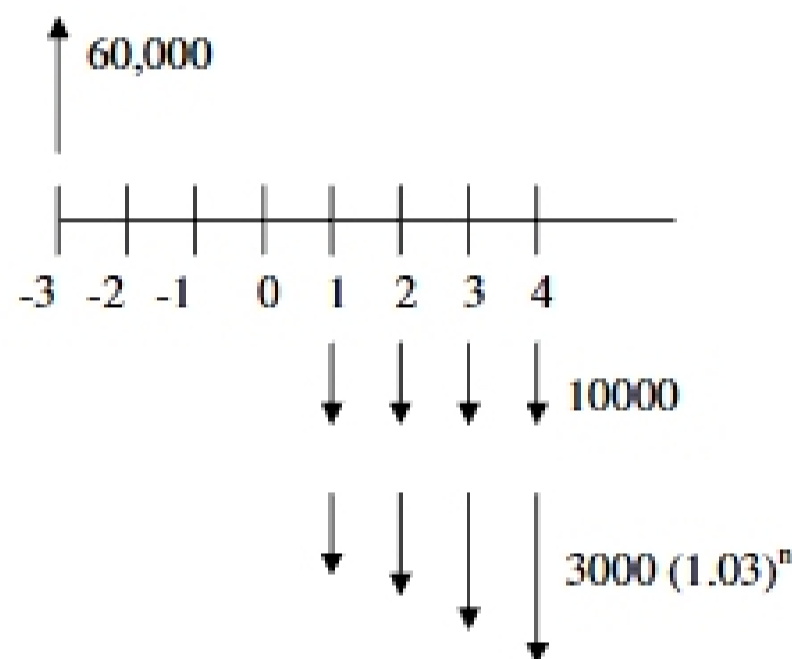
Year	0	1	2	3	4	5
Cash flow	0	50	100	100	100	50

Find P in year 0 then convert to A

$$\begin{aligned} A &= 50 * (P/A, 10\%, 3) * (P/F, 10\%, 1) * (A/P, 10\%, 5) + 50 \\ &= 50 * 2.487 * 0.9091 * 0.2638 + 50 \\ &= 79.822 \end{aligned}$$

**11. (20 points)** 3 years ago, Sandy's parents deposit \$60,000 into his bank account that pays interest rate 3% per year. One year from now, Sandy will withdraw money annually to pay for his car and school fees. His car payment is \$3,000 the first year and increase by 3% each year for the next three years. (4 payments in total). His tuition fee for his school is constant at \$10,000 for 4 years (4 payments in total).

- (5 points)** Draw the cash flow diagram for Sandy.
- (15 points)** Calculate how much money he would have left at the end of year 4?



Effective rate = 3%

$$\begin{aligned} \text{(a) Future value of 20,000} &= 6,000 * (F/P, 3\%, 7) \\ &= 6,000 * 1.23 = 73800 \end{aligned}$$

$$\begin{aligned} \text{(b) Future value of uniform series} &= 10000 * (F/A, 3\%, 4) \\ &= 10000 * 4.184 = 41840 \end{aligned}$$

$$\begin{aligned} \text{(c) Future value of geometric gradient series} &= 3000 * (P/A, 3\%, 3\%, 4) * (F/P, 3\%, 4) \\ &= 3000 * (4/1.03) * 1.126 = 13118,45 \end{aligned}$$

$$\begin{aligned} \text{Total future value} &= 73800 - 41840 - 13118.45 \\ &= 18841.55 \end{aligned}$$

*For part (c), arithmetic gradient series can also be used.*

*arithmetic gradient*

$$\text{series} = 3000 * (F/A, 3\%, 4) + 3000 * 3\% * (P/G, 3\%, 4) * (F/P, 3\%, 4) = 3000 * 4.184 + 90 * 5.438 * 1.126 = 13109.09$$

$$\text{Total future value} = 73800 - 41840 - 13109.09 = 18850.91$$