Midterm Solution Set

1-

(a) Effective monthly interest rate $= \frac{12\%}{12} = 1\%$.

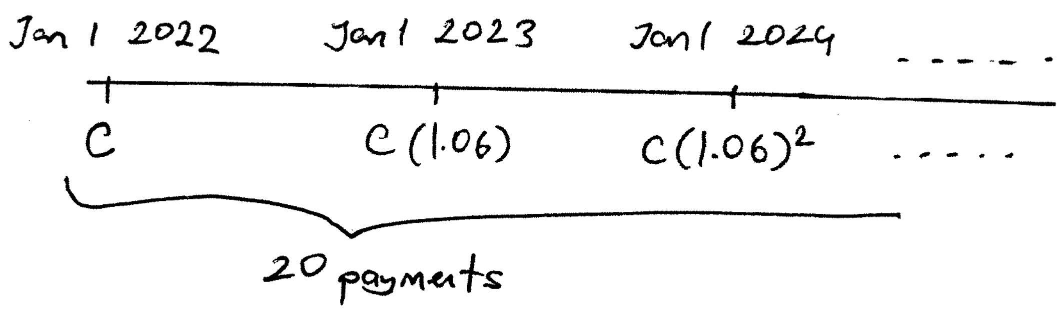
$\Rightarrow r_q \equiv$ Effective quarterly interest rate $= 1.01^3 - 1 = 0.0303$

and $EAR = 1.01^{12} - 1 = 0.1268$

PV of the first year's payments on Jan 1, 2022 is:

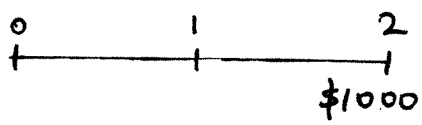
$$10000 + \frac{10000}{r_q}\left(1 - \frac{1}{(1+r_q)^3}\right) = 38\,269.75 \equiv C$$

Since quarterly payments increase by 6% at the end of every year, we get the following cashflow which is equivalent to the cash flow corresponding to all quarterly salaries:

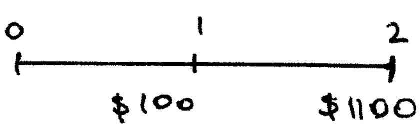


$$PV = \frac{C}{0.1268 - 0.06}\left(1 - \left(\frac{1.06}{1.1268}\right)^{20}\right) \cdot \frac{1}{1.1268^{12}} = 96422.07$$

(b)



$P_0 = 890 \Rightarrow$ \$1 in 2 yrs is equivalent to $\$\frac{890}{1000} = \$0.89$ today.



$P_0 = 1072$

Using the previous bond, \$1100 in 2 yrs is equivalent to $\$1100 \times 0.89$

$= \$979$ today. Thus, \$100 in one year is worth $1072 - 979 = \$93$ today which implies \$1000 in one year is worth \$930 today. But the new bond pays \$1000 in one year, so the price of the new bond is \$930. The company needs to issue $\frac{1000000}{930} \approx 1075$ bond.

2- Depreciation per yr is $(600000 - 200000)/2 = 200{,}000$.

$\Rightarrow$ OCF per yr $= (0 - (-400000) - 200000)(1 - 0.4) + 200000 = 320000$

After-tax salvage value $= 20000 - 0.4(20000 - 200000) = 92000$

The project cash-flow becomes:

0	1	2
−600000 (fixed)	+100000 (NWC)	+200000 (NWC)
−300000 (NWC)	+320000 (OCF)	+92000 (Salvage)
		+320000 (OCF)

$$\Rightarrow NPV = -900{,}000 + \frac{420{,}000}{1.12} + \frac{612{,}000}{1.12^2} = -37117.35$$

$\Rightarrow$ Reject!

3- (a) We need to compare the durations since duration is a direct measure of interest rate risk. Since Bond A is a zero-coupon bond, its duration is equal to its maturity which is 10 yrs. Therefore, Bond A has more interest rate risk since its duration is higher than Bond B's duration (8 yrs). False.

(b) Since the rate is zero, payback = discounted payback. So, we have discounted payback = 3 yrs. This implies: PV of the first 3 yrs' payments is equal to the initial cost. But cashflows after yr 3 are nonnegative since the cashflow is conventional. This implies:

$$PV(\text{future cashflows}) \geq \text{Initial cost} \Rightarrow PI = \frac{PV(\text{future cash flows})}{\text{Initial cost}} \geq 1$$

TRUE

(c) $L = \dfrac{C_A}{rate(A)/12}\left(1 - \dfrac{1}{\left(1+\frac{rate(A)}{12}\right)^{360}}\right)$

$\qquad \shortparallel$

$L = \dfrac{C_B}{rate(B)/12}\left(1 - \dfrac{1}{\left(1+\frac{rate(B)}{12}\right)^{360}}\right)$

Since $C_A > C_B$, we have $rate(A) > rate(B)$. But then:

$APR(A) \geq rate(A) > rate(B)$

$\Rightarrow APR(A) > rate(B)$. True.

(d) False. Counter-example:

A: 1, 2, ..., 10
100, 100, ..., 100

B: 1, 1.01, 1.01^2, 1.01^3, ...

Required return for both $= 0 \Rightarrow P_A = 1000$

$P_B = \dfrac{1}{1.01} = 100$

(e) False. NPV's will be <u>equal</u> to each other, so any example would be counterexample. A quick counter-example is attained by making inflation rate = 0 in which case:

$\left.\begin{array}{l}\text{real cash flows} = \text{nominal cash flows} \\ \text{real rate} = \text{nominal rate}\end{array}\right\}$ Both NPV's are the same.