ENG110 *Second Midterm Exam*
Winter 2018
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Multiple Choice Questions (4 points each)

1. Which of the following statements is NOT correct:
   a) AVC eventually *increases* as more is produced due to *capacity* constraints.
   b) AVC will be equal to MC at each Q, if MC is a fixed number that is independent of Q.
   c) The Demand that a perfectly competitive firm faces for its own product is highly price sensitive (i.e. when price changes, Q demanded changes by a lot)
   d) In Oligopoly, companies sell differentiated commodities. That is, the product cannot be homogenous across firms.

2. If you make the correct decision by choosing A over B and C when the market rate is 10% and IRR of A-B is 8% and IRR of C is 5%, then:
   a) C must have a borrowing type cash flow
   b) A must have a borrowing type cash flow
   c) B must have an IRR lower than the market rate
   d) None of the above

   IRR A-B < MARR ✓ choose opt 1
   opt opt 2

3. Use the following table for both question 3 and question 4. Let P be a positive number. Given the cash flow table below, what is P if NPV_I is zero at 8%? $IRR_I = 8\%$

Year	0	1	2	3	4	5	6	7	8
Cash Flow I	-P	1,000	1,000	1,000	1,000	1,600	1,600	1,600	1,600
Cash Flow II	-P	1,500	1,500	1,500	1,500	1,000	1,000	1,000	1,000

   a) $1600(F/A,8\%,4) / 1.08^8 + 1000(F/A,8\%,4) / 1.08^4$
   b) $1600(P/A,8\%,4) / 1.08^4 + 1000(F/A,8\%,4) / 1.08^8$
   c) $600(P/A,8\%,4) / 1.08^8 + 1000(P/A,8\%,8)$
   d) $600(F/A,8\%,4) / 1.08^4 + 1000(P/A,8\%,8)$
   e) None of the above

   NPV = 0 = -P
   P =

4. Which of the following is correct:
   a) IRR of II is less than IRR of I.
   b) IRR of I-II is greater than 8%.
   c) If you prefer II over I, market rate must be greater than 8%.
   d) None of the above

5. How much longer will it take for a sum of money to double in value, if invested at 5% APR compounded annually rather than monthly:
   a) About 2.3% longer
   b) About twice as long
   c) About 5% longer
   d) About 3.38% longer
   e) None of the above

   $2 = (F/P, 5\%, n)$
   $2 = (1.05)^n$ Annual
   $\log_{1.05} 2 = n$ 14.2 yrs

   $2 = (F/P, 0.42\%, n)$ months
   $2 = (1.0042)^n$
   $\log_{1.0042} 2 = n$
   $n = 166$ months 13.83 yrs

6. A and B are two projects (with exactly the same cash flow) that your company is considering investing on. B is a riskier project than A.

a) If you accept A at 10%, you also accept B.
b) If you accept A at 10%, you must reject B.
c) If you reject B at 15%, you must accept A.
d) If you reject B at 15%, you should also reject A.
e) None of the above.

7. You borrowed today $50,000 at 12% compounded monthly to be paid back in 36 months. You are expected to pay accumulated interest and 1/36th of the principle each month. How much is your 20th payment?

a) 1,653
b) 1,639
c) 1,625
d) 1,611
e) none of the above

1.389K principle each month

2381 left

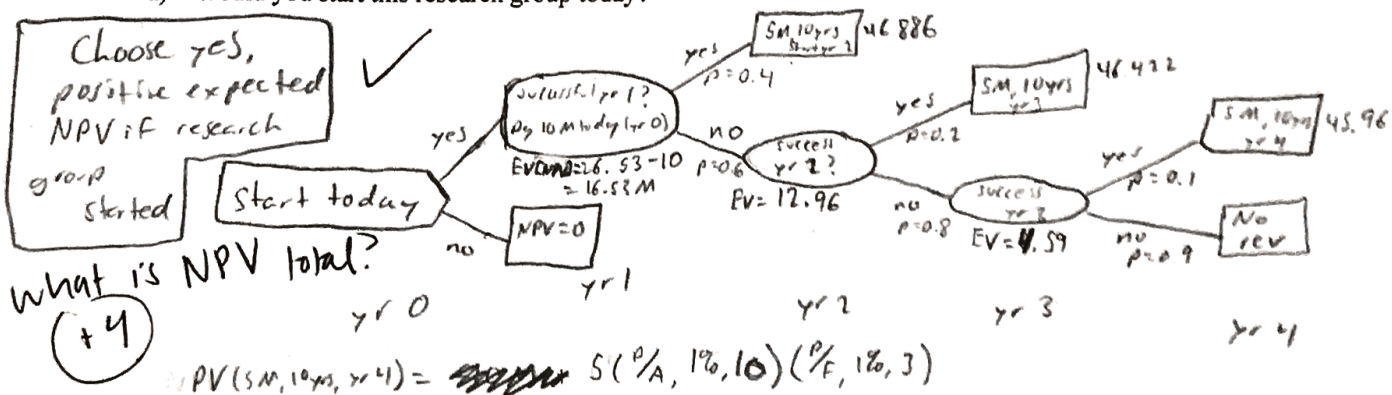
0.2381K interest

Numeric Problems (18 points each):

1. Assume the market rate is 1% per year. You can start a research group to work on a specific product today (year 0) to end in 3 years from today or when you register success, whichever comes first. If you start, you need to invest $10m today. The product, if successful, will bring $5m per year for 10 years, beginning a year after the success is registered. The probability that the product is successful in the first year (year 1) is 40%. Success probability goes down by half every year, given that product has not been successful in the previous year.

bring all revenue to yr 0 to compare

a) Would you start this research group today?



what is NPV total? (+4)

$PV(\$5M, 10yrs, yr4) = \$5(P/A, 1\%, 10)(P/F, 1\%, 3)$
$= 45.96$ (9471, 0.9706)

$PV(\$5M, 10yrs, yr3) = \$5(P/A, 1\%, 10)(P/F, 1\%, 2)$
$= 46.422$

$PV(\$5M, 10yrs, yr2) = \$5(P/A, 1\%, 10)(P/F, 1\%, 1)$
$= 46.886$

b) By investing $4m in year 3 (last year), you can increase the probability of success of that year by 10% in case product has not been a success up to that point (*that is, if probability was x%, it becomes (x+10)%*) . Would you choose to invest $4m in year 3, in case you find yourself in that position?

4M in year 3 $P = 4(P/F, 1\%, 3)$
$= 3.8824$ yr 0 ✓ (+2)

so yr 4 rev = 45.96 - 3.8824
= 42.078M but p=0.2

so EV[success 3] = 8.416 EV[success 2] = 16.017

EV[success 1] = 28.364 with

EV[NPV] = 18.364 which is greater than previous NPV so yes do it ✓

c) What is the internal rate of return of investing $4m in year 3? (Hint: Think about the cash flow that will ensue with and without the $4m investment. Only writing down the equation is enough to get full points. You do not need to solve the equation.)

$NPV_{with-without} = 0 = -4(P/F, i, 3) + (0.1 \cdot \$5(P/A, i, 10)(P/F, i, 3))$

extra period — extra income

NVM ok!

* All other payments or revenue are the same for both options so not included

(+8) (10)

2. Recall the oil drilling example in your last Discussion Session. At a cost of \$15M today, you can drill to obtain \$5M or \$1M per year for the coming 15 years beginning a year from today, each with 50% chance depending on the reserves being rich or poor. MARR is 10%.

A company offers you an insurance plan.

The terms of the plan: Pay \$X today to obtain a one-time \$3M (at t=1, when the first revenue from the well is obtained) if the reserves end up being poor.

Would you buy this plan? At most how much \$X would you pay?

Expected NPV of drilling: $-15M + (0.5 \cdot 5(P/A, 10\%, 15)) + (0.5 \cdot 1(P/A, 10\%, 15))$

$= -15M + (0.5 \cdot 5 \cdot 7.606) + (0.5 \cdot 1 \cdot 7.606)$

$= -15M + 19.015M + 3.803M$

$= 7.818$

yes I would buy this plan because it results in a higher expected NPV than if it is not bought. I would only buy it at a max price of \$1.364M

First, find out how much we would pay. We don't want NPV to go down

$7.818 = -15M - x + 19.015M + (0.5(1 \cdot 7.606 + 3(P/F, 10\%, 1))$

$= -15M - x + 19.015M + 5.167$

$7.818 = 9.182 - x$

$x = 1.364M$ +18

3. A company has two options to pay off its taxes of \$300,000 owed to IRS.

I. Pay all cash today.
II. Defer taxes to be paid in two years. For the first year, IRS does not charge any interest but for the second year, it charges 8% (annual compounding).

What is the internal rate of return (IRR) of the deferred tax offer?

Bring all to year 2. If option II taken, amount to pay in year 2 is $300k(1.08)^1 = 324K$

$NPV_I = NPV_{II}$ (in yr 2)

$-300(F/P, i, 2) = -324$ +18

$300(1+i)^2 = 324$

$(1+i)^2 = 1.08$

$1+i = 1.0392$

$i = 3.92\%$

so use EUAW

4. You have three options for purchasing a machine to be used in a project that will run forever. One option is to choose Alternative 1 and renew it as its useful life ends. Another option is to choose Alternative 2 and renew it as its useful life ends. The third option is to use either alternative 1 or 2 for the first 10 years and lease a machine afterwards that will cost $6,500 per year. Which option would you choose if discount rate is 8%?

Alternatives	*Alt. 1*	*Alt. 2*
Initial Cost	*$50,000*	*$65,000*
Estimated salvage value at end of useful life	*$10,000*	*$5,000*
Useful Life	*7 years*	*11 years*
Estimated market value, end of year 10	*$20,000*	*$15,000*

$EUAW_I = -50k\,(A/P, 8\%, 7) + 10K(A/F, 8\%, 7)$

$= -50k \cdot 0.1921 + 10k \cdot 0.1121$

$= -9.605 + 1.121$

$= \boxed{-8,484}$ ✓

choose option I, lowest EUAC

$EUAW_{II} = -65k\,(A/P, 8\%, 11) + 5k(A/F, 8\%, 11)$

$= -65k \cdot (0.1401) + 5k \cdot 0.0601$

$= -9.1065 + 0.3005$

$= -8,806$ ✓ +8

TA didn't know how to clarify this problem

perpetuity, neither end of eternity

$NPW_{III} = \text{Average cost of two AHs} - \frac{A}{i}(P/P, 8\%, 10)$ +3 good!

$= \frac{(20k\,(P/P, 8\%, 10) - 50) + (15k\,(P/F, 8\%, 10) - 65k)}{2} - \frac{6.5k}{0.08}(P/F, 8\%, 10)$

looks like you misread

$= \frac{(-40.736) + (-58.01)}{2}$ ✓ +2 $- 37.63$

this one wrong

$= -49.394 - 37.63$

$= -87.024$

No too bad!

$EUAW_{III} = NPW_{III}(A/P, 8\%, 10)$

$(-87.024 \cdot 0.1490)$

$= -12.966$