Midterm 1 Solution

1) At some point in time Roger had $5,500 in spare cash. He deposited this money in his bank account that pays a 1.1% annual interest rate. After one year he was approached by his friend who said that he could offer Roger an investment deal for a three-year period. What would the market equivalence be of Roger's money?

A) $5,500

B) $5,684

C) $5,746

D) $5,622

E) $5,894

Answer: **C**

Here,
P = $5,500
r = 1.1% = 0.011
$F = P(1 + r)^4 = 5,500\ (1 + 0.011)^4 = 5,746$

2) Peter wants to buy a new car in three years from now. He expects that the price of a car will be $15,000 in three years. How much money should Peter put in his savings account now if a bank pays 10% interest rate on this account?

A) $14,104

B) $12,958

C) $12,129

D) $11,270

E) $10,465

Answer: **D**

Here,
F = $15,000
r = 10% = 0.1
$P = F/(1 + r)^3 = 15,000/(1 + 0.1)^3 = 11,270$

3) If the effective equivalent annual interest rate is 18.5%, and interest is compounded weekly, what is the corresponding nominal annual interest rate?

A) 11%

B) 17%

C) 19%

D) 15%

E) 13%

Answer: **B**

Here,

$i_e = 16.2\% = 0.162$

$m = 52$

$r = ?$

Formula is:

$i_e = (1 + r/m)^m - 1$

$\Rightarrow (1 + i_e)^{1/m} = (1 + r/m)$

$\Rightarrow (1 + i_e)^{1/m} - 1 = r/m$

$\Rightarrow r = m * \{(1 + i_e)^{1/m} - 1\}$

By plugging the values of the known variables, we obtain $r = 17\%$

4) It is known that the total interest paid over a 5-year period is $2,584.07. What was the principal amount borrowed at a 6% nominal interest rate compounded quarterly?

A) $4,123

B) $6,745

C) $7,450

D) $8,233

E) $9,189

Answer: **C**

Here,

$r = 6\% = 0.06$

$m = 4$

$i_e = ?$

Formula is: $i_e = (1 + r/m)^m - 1$

By plugging the values of the known variables, we obtain $i_e = 0.0613636$

Now, Interest amount, I = $2,584.07 and N = 5

We know, future value F = P + I

Also, $F = P (1 + i_e)^N$

Hence, $P + I = P (1 + i_e)^N$

$\Rightarrow I = P \{ (1 + i_e)^N - 1\}$

$\Rightarrow P = I / \{ (1 + i_e)^N - 1\}$

By plugging the values of the known variables, we obtain P = $7,450

5) If you borrow $4,000 today at 10% interest rate for 5 years, what is your simple interest in this case?

A) $2,000

B) $2,500

C) $3,000

D) $3,500

E) $4,000

Answer: **A**

Here,
P = $4,000
i = 10% = 0.1
N = 5
I = ?
So, I = P * i * N = 4,000 * 0.1 * 5 =2,000

6) How long will it take for any deposit to double in value if the effective annual interest rate is 10%?

A) 11.5 years

B) 9.1 years

C) 7.3 years

D) 5.9 years

E) 3.7 years

Answer: **C**

Here,
$2P = P (1 + i)^N$
$=> 2 = (1 + i)^N$
$=> \ln (2) = N \ln (1 + 0.1)$
$=> N = \ln(2) / \ln(1.1) = 7.3$ years

7) What does the term "market equivalence" imply?

A) the ability to exchange one cash flow for another at no cost

B) the ability to obtain a zero net cash flow

C) the existence of a mathematical relationship between time and money

D) indifference on the part of a decision maker among available choices

E) the ability to exchange one cash flow for another at minimum cost

Answer: **A**

8) If nominal interest rate is 18% per year, what is the equivalent interest rate per quarter?

A) 4.5%

B) 8.6%

C) 4.8%

D) 6.2%

E) 3.8%

Answer: **A**

Here,
r = 18% = 0.18
m = 4
i_s = ?

i_s = r/m = 0.18 / 4 = 0.045 = 4.5%

9) Joanne is considering two mutually exclusive financial options: (i) to deposit $4,000 in her bank's savings account that pays 10% annual interest, or (ii) to purchase a $4,000 one-year guaranteed investment certificate with a monthly interest rate of 1.5%. From an opportunity cost standpoint, by making the decision to deposit $4,000 in the bank account, Joanne will

A) lose $282 by the end of the year.

B) gain $196 by the end of the year.

C) gain $282 by the end of the year.

D) make zero economic profit.

E) lose $382 by the end of the year.

Answer: E

Here,
P = $4,000
$F = P (1 + i_e)^1$ = ?

Option i):
i_e = 10% = 0.1
$F_1 = P (1 + i_e)^1 = 4{,}000 (1 + 0.1)^1 = 4{,}400$

Option ii):

The effective interest rate but with monthly interest period (that is, the compounding period is a month as oppose to a year) is, $i_s = 1.5\% = 0.015$. In order to be able to compare between the two options, first we need to find the equivalent effective interest rate with the interest period one-year, i_e

So, $i_e = (1 + i_s)^m - 1 = (1 + 0.015)^{12} - 1 = 0.195618$, where m = 12

$F_2 = P(1 + i_e)^1 = 4{,}000\ (1 + 0.\ 0.195618)^1 = 4{,}782$

Hence, { Option i) – Option ii) } = 4,782 – 4,400 = 382

10) The following table summarizes information for five projects:

Project	First Cost (in $)	IRR on Overall Investment	IRR on increments of investment Compared with Projects (%)			
			1	2	3	4
1	100,000	19%				
2	175,000	15%	9%			
3	200,000	18%	17%	23%		
4	250,000	16%	12%	17%	13%	
5	300,000	17%	14%	11%	17%	16%

The data can be interpreted in the following way: The IRR on the incremental investment between project 5 and project 4 is 16%.

If all projects are <u>mutually exclusive</u> and the company has at least $1,025,000 to invest, which projects should be undertaken if the MARR is 10%?

A) only 5.

B) 1, 2, 3, 4 and 5.

C) only 1.

D) 2 and 4.

E) 1, 3 and 5.

Answer: A

Note that the question identifies that the projects are <u>mutually exclusive</u>. Hence, only one project can be taken up although all projects has <u>individual IRR</u> that is higher than the MARR of 10%. To find out the best project, we need to do pairwise comparison using the incremental IRRs.

Comparison of project 1 vs 2: Incremental IRR = 9% < MARR => Project 1 is better than 2.
Comparison of project 1 vs 3: Incremental IRR = 17% > MARR => Project 3 is better than 2.
Comparison of project 3 vs 4: Incremental IRR = 13% > MARR => Project 4 is better than 3.

Comparison of project 4 vs 5: Incremental IRR = 16% > MARR => Project 5 is better than 4.

So, Project 5 should be undertaken.

11) If you invest $30,000 today at 10% interest rate, how much of interest will you accumulate in 30 years?

A) $612,754

B) $523,482

C) $493,482

D) $369,165

E) $295,578

Answer: C

Here,
P = $30,000
I = F – P = ?

$F = P(1 + i)^N = 30{,}000\ (1 + 0.1)^{30} = \$523{,}482$
I = F – P = $523,482 – $30,000 = $493,482

12) I can invest for a pension in either the Senex or the Geriatrix pension plan. Senex requires me to invest $1,500 a year for the next 15 years, whereas Geriatrix requires an immediate deposit of $5 000 and a subsequent annual investment of $1,200 a year. If my MARR is 10%, how much greater is the present cost to me of the series of payments I would make to Geriatrix versus the series of payments I would make to Senex?

A) $4,222

B) $3,863

C) $4,127

D) $2,457

E) $2,718

Answer: E

Here,
N = 15 years
i = 10% = 0.10

Geriatrix option:
P = 5,000
A = $1,200, where the first payment is to be made in a year's time

PW (Geriatrix) = P + A * (P|A, i, N) = 5,000 + 1,200 * (P|A, 0.10, 15)
= 5,000 + 1,200 * 7.6061 = 14,127.32

Senex option:
A = $1,500, where the first payment is to be made in a year's time
PW (Senex) = A * (P|A, i, N) = 1,500 * (P|A, 0.15, 15) = 1,500 * 7.6061 = 11,409.15

The difference in PW between Geriatrix and Senex is:
Difference = PW (Geriatrix) - PW (Senex) = 14,127.32 - 11,409.15 = $2,718.17

13) In general, the IRR comparison method and the PW comparison method

A) produce the same results for independent projects but not for mutually exclusive projects.

B) produce the same results for independent projects and mutually exclusive projects with equal lives.

C) produce different results for both independent projects and mutually exclusive projects.

D) produce the same results for independent projects and mutually exclusive projects with unequal lives.

E) produce the same results for mutually exclusive projects but not for independent projects.

Answer: B

14) I have 3 possible choices for a lawnmower. They have expected working lives of 3, 4 and 5 years. If I expect lawnmower technologies to be stable for the foreseeable future, over what period of time should I compare the equivalent uniform annual costs of the three choices?

A) 45 years

B) 12 years

C) 30 years

D) 20 years

E) 60 years

Answer: E

This question required the application of the concept of repeated lives since:

- the working lives of three different lawnmower is different (i.e., 3, 4 and 5 years); and
- the technology for foreseeable future is stable.

Hence, you needed to find the least common multiplier for 3, 4 and 5 years, which is 60 years.

15) Patricia has decided to upgrade the packaging machine in the production line of her plant. The initial cost would be $280,000 with a salvage value of $60,000 after seven years. How much money must be saved every year to justify the investment at an interest rate of 10%?

A) $11,128.52

B) $36,145.03

C) $38,501.95

D) $51,189.21

E) $14,478.38

Answer: D

Here:
P = 280,000
S = 60,000
N = 7
i = 10% = 0.1
A = ?

Hence, using capital recovery formula: $A = (P - S) * (A|P, i, N) + S*i$
$= (280,000 - 60,000) * (A|P, 0.1, 7) + 60,000 * 0.1$
$= 220,000 * 0.20541 + 60,000 * 0.1 \approx 51,189.21$

16) A project requires no initial investment. It costs $4 000 a year from now and earns $8 000 two years from now. What is its internal rate of return?

A) 100%

B) 50%

C) 75%

D) 24%

E) 141%

Answer: A

Here:
PW(cost) = $4,000/(1 + i)$
PW(benefit) = $8,000/(1 + i)^2$
Hence, using the definition of IRR we have:
PW(cost) = PW (benefit)

$\Rightarrow 4{,}000/(1 + i) = 8{,}000/(1 + i)^2$
$\Rightarrow 4{,}000 = 8{,}000/(1 + i)$
$\Rightarrow (1 + i) = 8{,}000/4{,}000$
$\Rightarrow (1 + i) = 2$
$\Rightarrow i = 2 - 1 = 1 = 100\%$

17) What is the exact payback period for a 10-year project that requires $12,000 in initial investment, $1,000 in annual maintenance costs and generates annual revenue of $2,600 per year under 10% MARR?

A) 7.9 years

B) 10 years

C) 7.5 years

D) 9.2 years

E) 8.4 years

Answer: C

We know:
Payback period = (Initial investment)/(Annual savings)
Here:
Initial investment = 12,000
Annual savings = Annual revenue - Annual maintenance cost
= 2,600 - 1,000 = 1,600
Hence, Payback period = 12,000/1,600 = 7.5 years

18) The minimum acceptable rate of return (MARR) is

A) the least interest rate among all alternative projects.

B) an interest rate that allows an investor to recoup the investment.

C) an interest rate, which is equal to a current bank interest rate.

D) a highest interest rate among all alternative projects.

E) an interest rate that must be earned for a project to be accepted.

Answer: E

19) How much should be set aside each month to accumulate $10,000 at the end of year 2.5 under 120% nominal interest rate compounded monthly?

A) $141

B) $94

C) $79

D) $61

E) $56

Answer: D

Note that the question is asking how much needs to be set aside monthly. Hence, there is no need to find effective interest rate with compounding period of one year. The effective interest rate with compounding period of one month, which is the period interest rate, i_s, should be used in this question:

Hence, here:

F = 10,000

Nominal interest rate, r = 120%

m = 12

Thus, $i_s = r/m = 120\%/12 = 10\% = 0.1$

N = 2.5 years = 30 months

A = ?

Thus, $A = F * (A|F, i, N) = 10,000 * (A|F, 0.1, 30) = 10,000 * 0.00608 = 60.8 \approx \$61$

20) The internal rate of return (IRR) is negative if

A) IRR cannot be negative.

B) a project is a simple investment.

C) a project just breaks even.

D) a cash inflow exceeds a cash outflow.

E) a project is losing money.

Answer: E

21) Jennifer lends $2,000 to her friend who is launching a small business. Her friend promises to pay her 10% per year compounding interest. How much interest would Jennifer get at the end of four years?

A) $2,823

B) $1,284

C) $2,324

D) $928

E) $892

Answer: D

Here:

P = 2,000

i = 10% = 0.1

Total principal plus interest at the end of four years, $F_4 = P * (1 + i)^4$

$= 2000 * (1.1)^4 = 2000 * 1.4641 = 2,928.2$

Hence, total interest received in four years, $I_4 = F_4 - P = 2,928 - 2,000 = 928$

22) You want to have a million dollars in the bank when you retire. You think you can save $5,000 a year in a bank that offers you 10% interest. If you make your first deposit in a year's time, how many years will it be from now before you can retire?

A) 62

B) 72

C) 32

D) 52

E) 42

Answer: C

Here:

F = 1,000,000

A = 5,000

i = 10% = 0.1

N = ?

We need to solve: $F = A * (F|A, i, N) = A * [\{ (1 + i)^N - 1\}/i]$

$\Rightarrow 1,000,000 = 5,000 * [\{ (1 + 0.1)^N - 1\}/0.1]$

$\Rightarrow 200 = [\{ (1 + 0.1)^N - 1\}/0.1]$

$\Rightarrow 200 * 0.1 = \{(1.1)^N - 1\}$

$\Rightarrow 21 = (1.1)^N$

$\Rightarrow \ln(21) = N * \ln(1.1)$

$\Rightarrow N = \ln(21)/\ln(1.1)$

$\Rightarrow N = 31.94 \approx 32$ years

23) I can buy a Grapefruit laptop computer for $3,000, or a Doors laptop for $2,500. The Grapefruit has an expected life of five years, whereas the Doors is only expected to last four years. Both provide equivalent service. A four-year-old Grapefruit has a salvage value of $200. If my MARR is 10%, what is the present cost of choosing the Grapefruit over the Doors?

A) $315

B) $300

C) $637

D) $383

E) $363

Answer: E

Here:

The difference between the first cost of Grapefruit and Doors laptop is: 3,000 - 2,500 = 500

Salvage value of Grapefruit after 4 years is, S = 200, where N = 4

So, present worth of salvage value is, PW(S) = S * (P|F, i, N) = 200 * (P|F, 0.1, 4)

= 200 * 0.68301 = 136.60 ≈ 137

Therefore, present cost of choosing Grapefruit over Doors laptop is: 500 - 137 = $363

24) The internal rate of return (IRR) is

A) the interest rate that ensures the positive cash flow of a project.

B) the interest rate that measures the return from operating costs

C) the interest rate that allows an investor to recoup the initial investment.

D) the interest rate that breaks even a project's costs and benefits.

E) the interest rate that is set up by an investor to guarantee that the return on investment will be higher than from a bank interest rate.

Answer: D

25) You need to borrow $1,000 for a period of 10 years. Bank A will lend you the money at 10% interest, compounded annually, whereas Bank B will lend you the money at 10% interest, compounded monthly. At the end of ten years, how much less interest will you owe if you borrow from Bank A instead of Bank B?

A) $137.39

B) $148.12

C) $74.59

D) $113.30

E) $92.50

Answer: D

Here:

Effective yearly interest rate for Bank A: $i_A = 10\% = 0.1$

For Bank B: r = 10% = 0.1 and m = 12. Hence effective interest rate: $i_B = (1 + r/m)^m - 1$

$= (1 + 0.1/12)^{12} - 1$

$= 0.1047$

For both banks, P = 1,000 and N = 10

For Bank A, $F_A = P * (1 + i_A)^N = 1,000 * (1.1)^{10} = 2,594.74$

For Bank B, $F_B = P * (1 + i_B)^N = 1,000 * (1.1047)^{10} = 2,707.04$

Therefore, the amount of less interest owed if borrowed from Bank A is:
Difference = 2,707.04 - 2,594.74 = 113.30

26) You have $100 to deposit. Bank A offers 16% interest, compounded annually, Bank B offers 15% interest, compounded monthly. How many years would you have to keep your money in the bank for Bank B to be a better choice?

A) 5 years

B) 6 years

C) Bank B is always better

D) Bank B is never better

E) 4 years

Answer: C

Here:
Effective yearly interest rate for Bank A: $i_A = 16\%$
For Bank B: r = 15% = 0.15 and m = 12. Hence effective interest rate: $i_B = (1 + r/m)^m - 1$

$= (1 + 0.15/12)^{12} - 1$

$= 0.1607 = 16.07\%$

That is, Bank B pays greater effective interest rate. Hence, Bank B is always better.

27) If you borrow $2,500 now at 10% interest for 7 years, what is the compound interest owed for the <u>seventh</u> year?

A) $2,372

B) $140

C) $1,929

D) $146

E) $443

Answer: E

Here:
P = 2,500
i = 10% = 0.1
N = 7
Total principal plus interest at the end of seven years, $F_7 = P * (1 + i)^7$

$= 2,500 * (1.1)^7 = 4,872$

Total principal plus interest at the end of six years, $F_6 = P * (1 + i)^6$

$= 2,500 * (1.1)^6 = 4,429$

Hence, the compound interest rate owed in the <u>seventh</u> year = 4,872 - 4,429 = 443

28) The price of money can be captured through

A) the present worth of an investment

B) the interest rate

C) the difference between benefits and costs that occur at different times

D) the consumer price index

E) the future worth of an investment

Answer: B

29) You invest $15,000 at 10% interest rate compounded monthly, what is your accumulated interest at the end of year 3?

A) $1 049

B) $4,025

C) $5,223

D) $5,012

E) $3,089

Answer: C

Here:

P = 15,000

r = 10% = 0.1, where $r = i_s * m$ with m = 12

N = 3

The effective interest rate: $i_e = (1 + r/m)^m - 1 = (1 + 0.1/12)^{12} - 1 = 0.1047 = 10.47\%$

Total principal plus interest at the end of three years, $F_3 = P * (1 + i_e)^3$

$= 15,000 * (1.1047)^3 = 20,223$

Hence, the compound interest earned over three year = 20,223 - 15,000 = 5,223

30) The principal amount is

A) the difference between the amount of money lent and the amount of money later repaid

B) the future value of money

C) the present value of money

D) the amount of money invested at the beginning

E) the annual equivalent value of money

Answer: D

31) The present worth factor, (*P*/*F*, *i*, *N*),

A) converts a series of repeated equal payments into the equivalent future amount

B) converts an annuity into the equivalent present amount

C) converts the future amount that is equivalent to a present amount

D) converts the future value equivalent to a series of equal payments

E) converts the present amount that is equivalent to some future amount

Answer: C

32) What would be an appropriate way to compare two projects with unequal lives?

A) annual worth comparison method

B) future worth comparison method

C) incremental present worth comparison method

D) study period method

E) present worth comparison method

Answer: D

33) Mutually exclusive projects can be compared in terms of present worth if

A) they have the same benefits

B) they have the same depreciation rate

C) they have the same rate of return

D) they have the same costs

E) they have the same service life

Answer: E

34) The following table summarizes information for five projects:

Project	First Cost (in $)	IRR on Overall Investment	IRR on increments of investment Compared with Projects (%)			
			1	2	3	4
1	100,000	19%				
2	175,000	15%	9%			
3	200,000	18%	17%	23%		
4	250,000	16%	12%	17%	13%	
5	300,000	17%	14%	11%	17%	16%

The data can be interpreted in the following way: The IRR on the incremental investment between project 5 and project 4 is 16%.

If all projects are independent and the company has at least $1,025,000 to invest, which projects should be undertaken if the MARR is 10%?

A) 3, 4 and 5

B) 1, 3, 4, and 5

C) 5 only

D) 3 only

E) 3 and 5

Answer: A

Note that the question identifies that the projects are independent. Hence, all projects with individual IRR higher than MARR can be taken up for investment as long as the company has enough financial resources. Here the company has $1,025,000, which is sufficient to take up all projects, if need be. We, therefore, need to consider if individual project has IRR ≥ MARR. Notice that all projects satisfy the condition except project 2. Hence option B is the asnwer.

35) The external rate of return must be used if

A) a project requires multiple investments and generates multiple benefits

B) a project involves only simple investments

C) a project starts with cash outflow

D) it is impossible to calculate the minimum acceptable rate of return

E) there are multiple internal rates of return

Answer: E