LEARNING GUIDE

Week No. __6___

TOPIC/S
ANNUITIES

I. EXPECTED COMPETENCIES

At the end of the topic, the student should be able to:

1. Calculate and solve problems of different classification of annuities.
2. Solve problems with regards to annuities.

II. CONTENT / TECHNICAL INFORMATION

DEFINITION:

1. Annuity - is a series of uniform payments made at equal intervals of time. **Series of payments** made at equal periods (i.e., annual, semi-annual, quarter, etc.)

ANNUITIES are established for the following purposes:

a. As payment of a debt by a series of equal payment at equal time intervals, also known as ***AMMORTIZATION***.
b. To accumulate a certain amount in the future by depositing equal amounts at equal time intervals. These amounts are called ***SINKING FUND***.
   (Helps prepare a person or a corporation for some future expenditure / paying of indebtness)
c. As a substitute periodic payment for a future lump sum payment.

2. Payment Interval- is the time between successive payments of an annuity.

3. Term of Annuity- is the time between the first payment interval and the last payment interval.

4. Periodic Payment- is the amount of each payment.

Examples of Annuities

1. Monthly payments of rent

2. Weekly wages

3. Annual Premiums in a life insurance policy

4. Periodic pensions

5. Periodic payments of installment purchases

ELEMENTS OF ANNUITY

A= periodic payment

P= present worth of all periodic payments

F or S = future worth or sum of all the periodic payments after the last payment is made.

i= interest rate per payment

n= number of payments

Classification of Annuities

1. **Annuity Certain** – payments begin and end at the fixed times (example: Installment payment)

1.1. Ordinary Annuity - In ordinary annuity, the payment is made at the end of each period starting from the first period.

1.2. Annuity Due – If the payment is made at the beginning of each period starting from the first period.

1.3. Deferred Annuity – In this type, the first payment is deferred a certain number of periods after the first.

2. Contingent Annuity – payments depend upon an event that can't be foretold accurately

(Example: Life insurance premiums because the payments end at the death of the insured. When an insured would die is uncertain.)

3. Perpetuity – annuity whose payments continue forever. (Example: Preferred stock dividends, annual scholarship)

$$\mathbf{P = A / i}$$

In Functional Symbol:

F = A (F/A, i%, N) – read: Find F given A at i% interest per interest period for N interest period.

Formula:

From sum of n terms of a Geometric Progression:

$$Sn = a \frac{r^n - 1}{r - 1}$$

Where:

a = first term = A

r = common ratio = (1+i)

n = no. of terms = n

Substitute assumption from the data above;

Future worth of A $$F = A \frac{(1+i)^n - 1}{i}$$

The factor (**1+i)** ^{n} **– 1 is called equal-payment-series compound amount factor**

The value of A with known F (sinking fund)

$$A = F \frac{i}{(1+i)^n - 1}$$

The factor **i / (1+i)** ^{n} **– 1 is known as equal-payment-sinking fund factor.**

Present worth of A

$$P = \frac{F}{(1+i)^n} = \frac{A\,(1+i)^n - 1}{(1+i)^n\, i}$$

The factor **(1+i)** ^{n} **– 1 / i (1+i)** ^{n} **is known as equal-payment- series present worth factor**

The value of A with known P (capital recovery)

$$A = \frac{P\,(1+i)^n\, i}{(1+i)^n - 1}$$

The factor **(1+i)** ^{n} **i / (1+i)** ^{n} **- 1 is known as equal-payment- series capital recovery factor**

Sample Problems:

Ordinary Annuity:

1. P6, 200.00 debts bear interest at 8% compounded annually. It is to be repaid in annual payments of P1, 000.00 each.

    a. How many payments must the debtor make? (8.9)

    b. How much will be the final payment if it is made one year the last P1, 000.00 payments. (P906.27)

2. A P10, 000 loan is to be paid off in 10 equal annual payments. The annual interest rate is 15%. How much interest will be paid in the first two years?

3. The monthly rent of a house is P9, 000.00 payable at the beginning of each month. If money is worth 12% compounded monthly, what is the cash equivalent of 5 years rent?

4. What sum should be invested at the beginning of each quarter, at 16% compounded quarterly in order to have P25, 000.00 in a fund in 10 years.

5. Five thousand pesos is deposited at the end of each year for 15 years into an account earning 7.5% compounded continuously. Find the amount after 15 years.

6. A man made a year-end payment of P100, 000 to an account earning 7% annually for 10 years. How much is in the account after 20 years?

Deferred Annuity:

1. Find the present value of 10 payments at P100.00 each if the first payment is due at the end of 3 ½ years and if money is worth 12% compounded semi-annually. (P518.85)

2. If money is worth 8% compounded quarterly, find the present value of a P100.00 annuity every 3 months, the first of which is due at the end of 4 years and the last at the end of 10 years.

Perpetuity:

1. If money is worth 7% effective, find the present value of a P4, 000.00 perpetuity payable every year. (P57, 142.86)

2. What sum when invested at 12% compounded semi-annually will provide P850.00 indefinitely at the beginning of every 6 months? (P1, 016.67)

3. Find the present value of quarterly payments of P1000.oo that start at the end of 3 ¼ years and continue indefinitely, if money is worth 16% compounded quarterly. (P15, 614.00)

III. PROGRESS CHECK

Instruction: Read, Analyze and solve what is being ask.

1. STL service and installation works purchased a diesel generator from the ABB Electric Company valued at P2, 500. 000.00 on an easy payment plan, as follows: 20% cash upon delivery of the unit and the balance to be paid in 24 monthly installments with 12 % nominal interest on the unpaid balance.

    a. How much would the STL pay each month to the ABB Electric Co.?

    b. If instead of the above terms, the STL decided to start a sinking fund to enable it to purchase the same motor after 2 years on cash basis at the same value less 10% discount for cash purchase, how much would the monthly deposit in the fund be, if the money will earn interest at 6%. Assume interest rates are compounded monthly.

2. You need a P70, 000.00 per year for four years to go to college. Your father invested an amount of P100, 000.00 in a 7% account for your education when you were born. If you withdraw the money worth P70, 000.00 at the end of your 18^{th}, 19^{th}, 20^{th} and 21^{st} years, how much much money will be left in the account at the end of your 22^{nd} year?

IV. REFERENCES

Leland Blank et. Al (2012), Engineering Economy, 7th Edition Graw-Hill, Wiley Publishing Inc. New York.

Park, Chan (2013) et. Al (2013), Fundamentals of engineering Economics, 3rd Edition, Pearson Education South Asia PTE. LTD., Singapore.

Horngren, Charles T. et. Al (2009), Accounting, 8yh Edition, Pearson Education South Asia, Philippines.

LEARNING GUIDE

Week No. 6

TOPIC/S
AMORTIZATION & SINKING FUNDS

I. EXPECTED COMPETENCIES

At the end of the topic, the student should be able to:

1. Prepare a table for monthly amortization and schedule for sinking fund deposits.

II. CONTENT / TECHNICAL INFORMATION

INTRODUCTION:

This topic is intended to give the details in applying annuity formulas to problems on fund accumulation and debt liquidation. Set-up on how amortization and sinking fund schedules will be presented as well as comparing amortization and sinking fund methods as means of paying debts.

DEFINITION:

1. Amortization-Is called to a method if a loan is repaid in installment, usually in equal amounts.

- In this method, each installment includes the repayment of principal and the payment of interest.

2. Sinking Funds - is called to a fund that is intended to raise a certain sum at some future date.

- Amount of any sinking fund deposit is the same and that it is deposited at regular intervals.

AMORTIZATION SCHEDULE:

When a loan is amortized, each payment can be broken down into payment of interest and repayment of principal. Take note in the example as shown in the next page, that one part goes to interest and another is placed in the table to reduce the principal.

Using the example on the next page, below is the step in constructing the amortization table:

1. The outstanding principal at the beginning of the first period is the original or principal amount of the loan.

2. Compute the periodic payment at end of payment using the Outstanding Principal, interest rate and the period of loan.

3. Consider the first period of the loan. Compute the interest at the end of the period or in the first period using the principal amount at the beginning of the loan.

4. Deduct A in the first period to its interest to give you the repayment of principal.

5. The outstanding principal at the end of the first period is equal to the difference between the outstanding principal at the beginning of the first period and the principal repaid.

6. Repeat the same procedure to all the entries in the amortization table.

Take Note:

1. The total repayments on the principal equal the original loan.

2. At the end of the term the total repayment is equal to the total interest paid plus the original loan.

3. The outstanding principal at the beginning of the term is the original loan.

4. The outstanding principal at the end of the term is equal to zero.

5. Interest payments decrease as payments on principal increase.

Below is an example in constructing an amortization schedule with headings and values for illustration purposes only. Assume the following interest rate, i = 16% converted semi-annually and repayment of P20, 000.00 loan in 5 semi-annual.

Period	**Periodic Payment at the end of period** **A (Php)**	**Payment on Interest at the end of period, I (Php)** **I = OP x i**	**Repayment of Principal at the of period, PR(Php)** **PR = A - I**	**Outstanding Principal at the of period, OP (Php)** **OP = OP - PR**
0				**20, 000.00**
1	5009.13	1600.00	3409.13	16590.87
2	5009.13	1327.27	3681.86	12909.01
3	5009.13	1032.27	3976.41	8932.60
4	5009.13	714.61	4294.52	4638.08
5	5009.13	371.05	4638.08	0
TOTAL	**25, 045.65**	**5045.65**	**20,000.00**	

SINKING FUND SCHEDULE:

Using the same data as of amortization schedule, take note the difference in constructing the sinking fund schedule. Below is an example with headings and values per period.

Period	Amount in fund at the beginning of the period (Php)	Interest earned on sinking fund at the end of Period, I (Php)	Sinking Fund deposit at the end of Period (Php)	Amount in Fund at the end of period (Php)
1	0	0	3409.13	3409.13
2	3409.13	272.73	3409.13	7090.99
3	7090.99	567.28	3409.13	11067.07
4	11067.07	885.39	3409.13	15361.59
5	15361.59	1228.93	3409.13	19999.65
TOTAL		**2953.83**	**17047.50**	**20013.90**

III. PROGRESS CHECK

A man paid 10% down payment of P200, 000.00 for a house and lot and agreed to pay the balance on monthly installments for 60 months at an interest rate of 15% compounded monthly. Determine the required monthly payment. Construct the monthly amortizations schedule.

IV. REFERENCES

Leland Blank et. Al (2012), Engineering Economy, 7th Edition Graw-Hill, Wiley Publishing Inc. New York.

Park, Chan (2013) et. Al (2013), Fundamentals of engineering Economics, 3rd Edition, Pearson Education South Asia PTE. LTD., Singapore.

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LEARNING GUIDE

Week No. 7

TOPIC/S

GRADIENT SERIES

I. EXPECTED COMPETENCIES

At the end of the topic, the student should be able to:

1. Exhibit more interest and, consequently, expend more efforts in learning the intricacies of the arithmetic gradient series cash flow.
2. Appreciate the real-life applications of gradient series.

II. CONTENT / TECHNICAL INFORMATION

Dealing with Gradient Series

Engineers frequently encounters situations involving periodic payments that increase or decrease by a constant amount G or constant percentage (growth rate) from period to period. We can easily develop a series of interest formulas for this situation, but Excel will be more practical tool to calculate equivalent values for these types of cash flows.

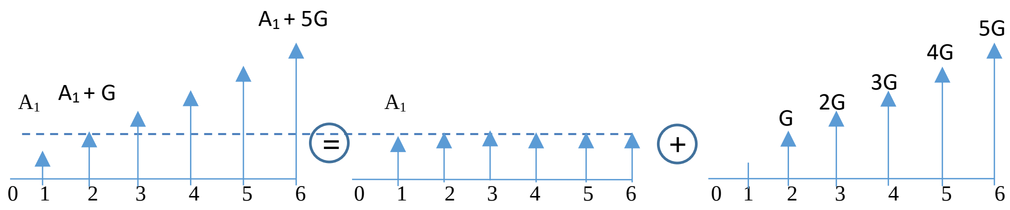
Handling Linear Gradient Series

Sometimes, cash flows will increase or decrease by a set amount, G, the gradient amount. This type of series is known as a strict gradient series as seen in the figure. Note that each payment is $\mathbf{A_n = (n - 1)\,G}$. Note also that the series begins with a zero cash flow at the end of period 1. If $G > 0$, the series is referred to as an increasing gradient series. If $G < 0$, it is referred to as a decreasing gradient series.

Design and Analysis of Tent Cash Flow Profiles

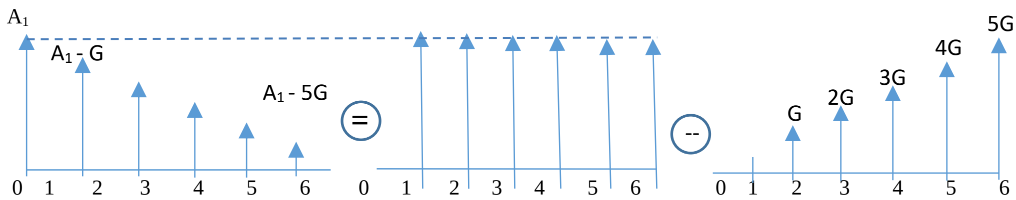
Real-life arithmetic gradient series cash flows usually start with some base amount at the end of the first period and then increase or decrease by a constant amount thereafter. The nonzero base amount is denoted as A_T starting at period T. The analysis of the present worth for such cash flows requires breaking the cash flow into a uniform series cash flow of amount A_T starting at period T and an arithmetic gradient series cash flow with a zero-base amount. The uniform series present worth formula is used to calculate the present worth of the uniform series portion while the basic arithmetic gradient series formula is used to calculate the arithmetic gradient series part of the cash flow profile. The overall present worth is then calculated as:

$$\boldsymbol{P} = \boldsymbol{P}_{\textit{uniform series}} \pm \boldsymbol{P}_{\textit{arithmetic gradient series}}$$



Years

(a) Increasing gradient series



Years

(b) Decreasing gradient series

Present-Worth Factor: Linear Gradient: Find P, Given G, N, and i

How much would you have to deposit now in order to withdraw the gradient amounts specified in the figure 1.

To find an expression for the present amount P, we apply the single-payment present-worth factor to each term of the series, obtaining

$$P = 0 + \frac{G}{(1+i)^2} + \frac{2G}{(1+i)^3} + \ldots\ldots + \frac{(n-1)\,G}{(1+i)^n}$$

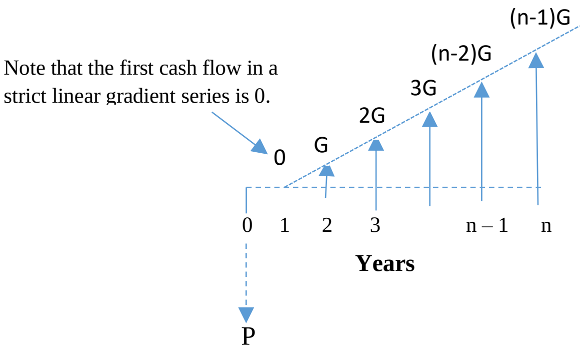


Figure 1. Cash flow diagram of a strict gradient series

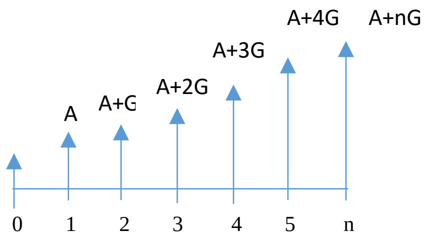


Figure 2. Cash flow diagram of a uniform (arithmetic) gradient

From the figure 2,

The present worth is:

Eq. 1. $$\mathbf{P} = \frac{A[(1+i)^n - 1]}{(1+i)^n\, i} + \frac{G}{i}\left[\frac{(1+i)^n - 1]}{(1+i)^n\, i} - \frac{n}{(1+i)^n}\right]$$

The future worth is:

Eq. 2 $$\mathbf{F = P\,(1+i)^n} = \frac{A[(1+i)^n - 1]}{i} + \frac{G}{i}\left[\frac{(1+i)^n - 1]}{i} - n\right]$$

Illustrative Example:

You borrowed P100, 0000.00 from a local bank with the agreement that you will pay back the loan according to a graduated payment plan. If your first payment is set at P15, 000.00, what would the remaining payment look like at a borrowing rate of 10% over five years?

Dissecting the Problem Basically, we are calculating the amount of gradient (G) such that the equivalent present worth of the gradient payment series will be exactly P 100, 000.00 at an interest rate of 10%.	***Given:*** P = P 100, 000.00, A_1 = 15, 000.00, N = 5 years, and I = 10% per year. *(See cash flow in the figure 2.* ***Find:*** G
Methodology *Method 1: Calculate Present Value*	***Solution:*** Since the loan payment series consists of two parts – (1) a P15, 000.00 equal payment series and (2) a strict gradient series (unknown, yet to be determined) – we can calculate the present value of each series and equate them with P 100, 000.00: *(using Eq. 1)* P100, 000.00 = P15, 0000(P/A, 10%,5) + G (P/G, 10%, 5) = 56, 861.80 + 6.8618G 6.8618G = 43138.20 **G = 6286.72**
Method 2: Use Excel's Spreadsheet	Using the EXCEL, we could reproduce the same result, as in table 1 First, we designate cells C5(interest rate) and C6 (borrowing amount) as input cells and cell E6 (present worth of the repayment series) as output cells. In terms of repayment series, the equal-payment portion is entered in cells C12 through C17. The gradient portion is listed in cells D13 in each period over the life of the loan. Finally, cells F13 through F17. Second, to use the Excel function, we will designate cell E5 as "by changing cell" and cell F6 as "set cell" with its value at 100, 000.00. The gradient amounts shown in cells D13 through D14. The correct gradient amount (G) is determined at P6286.72, which will cause the set cell value to be exactly P100, 000.00.

GRADIENT CALCULATIONS

Input:	Value	Output:	Value
Interest rate (%)	0.10	Gradient (G)	6286.72
Borrowed Amount	100,000	Present Worth (P)	100,000
Period	5		
Annuity	15000		

Sum of the present worth

Period	Repayment Series			Present Worth
(n)	A	G	Total	
0				
1	15000	0	15000	13636.36
2	15000	6286.7161	21286.72	17592.33
3	15000	12573.432	27573.43	20716.33
4	15000	18860.148	33860.15	23126.94
5	15000	25146.865	40146.86	24928.04

G computations	
Annuity value	56861.80154113
gradient value 1	3.790786769
gradient value 2	3.104606615
Grandient Total	6.861801541

Table 1. An Excel worksheet to determine the size of the Gradient Amount

(EXCEL file will be sent through GC or any online platform for your reference)

III. PROGRESS CHECK

1. Nica deposits her annual business profit into a savings account that pays 7% interest compounded annually. Her yearly profit increases by P30, 000.00 each year, and the initial profit amount is P75, 0000.00. Determine how much will be in the account immediately after the fifth deposit.
2. The maintenance expense on a machine is expected to be P75, 000.00 during the first year and to increase P20, 000.00 each year for the following ten (10) years. What present sum of money should be set aside now to pay for the required maintenance expenses over the ten-year period? (Assume 8% compound interest per year)

IV. REFERENCES

Leland Blank et. Al (2012), Engineering Economy, 7th Edition Graw-Hill, Wiley Publishing Inc. New York.

Park, Chan (2013) et. Al (2013), Fundamentals of engineering Economics, 3rd Edition, Pearson Education South Asia PTE. LTD., Singapore.

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LEARNING GUIDE

Week No. 8

TOPIC/S

EQUIVALENCE CALCULATIONS UNDER INFLATION

I. EXPECTED COMPETENCIES

At the end of the topic, the student should be able to:

1. Explain how the rate of inflation is calculated
2. Compute the rate of inflation
3. Identify the three functions of money.
4. Explain how banks create money through fractional reserve banking.
5. Explain the cause of inflation.
6. Provide examples of the costs of inflation

II. CONTENT / TECHNICAL INFORMATION

Measure of Inflation

Historically, the general economy has usually fluctuated in such a way as to experience inflation, a loss in the purchasing power of money overtime. Inflation means that the cost of an item tends to increase over time; or, to put it another way, the same peso amount buys less of an item over time. Deflation is the opposite of inflation, in that prices decrease over time, and hence a specified peso amount gains purchasing power. Inflation is far more common than deflation in the real world.

Consumer Price Index

Before we can introduce inflation into an equivalence calculation, we need a means of isolating and measuring its effect. Consumers usually have a relative and imprecise sense of how their purchasing power is declining based on their experience of shopping for food, clothing, transportation, housing over the years. Economist have developed a measure called the **consumer price index** (CPI), which is based on a typical **market basket** of goods and services required by the average consumer. This market basket normally consists of items from eight major groups:

1. Food and alcoholic beverages
2. Housing
3. Apparel
4. Transportation
5. Medical Care
6. Entertainment
7. Personal Care
8. Other goods and services

The CPI compares the cost of the typical market basket of goods and services in a current month with its cost at a previous time, such as one month ago, one year ago, or 10 years ago. The point in the past with which current prices are compared is called the **base period**. The index value for this period is set.

Producer Price Index

The consumer price index is a good measure of the general price increase of consumer products, but it is not good measure of industrial price increase. When performing engineering economic analysis, the appropriate price indices must be selected to accurately estimate the price increases of raw materials, finished products, and operating costs. For example, the cost to produce and deliver gasoline to consumers includes the cost of crude oil to refiners, refinery processing cost, marketing and distribution costs, and finally, the retail station costs and taxes.

The producer price index is calculated to capture this type of price changes over time for a specific commodity or industry. Form table 1 lists of CPI together with several price indexes over a number of years. From the table 1, we can easily calculate the price index (or inflation rate) of gasoline from 2010-2011 as follows:

$$\frac{303.6 - 244.8}{244.8} = 0.2402 = 24.02\%$$

Year (Base Period)	New CPI	Gasoline	Steel	Automobile (X100)
2002	$ 178.9	$ 89.0	$ 114.1	$ 134.9
2003	183.8	100.1	121.5	135.1
2004	188.0	126.1	162.4	136.5
2005	194.6	162.5	171.1	135.1
2006	210.5	217.7	186.6	130.6
2007	206.7	232.7	193.4	136.6
2008	214.8	294.3	207.5	135.2
2009	213.2	177.3	156.5	134.9
2010	218.0	244.8	195.8	138.2
2011	223.5	303.6	216.0	140.9

Since the price index calculated is positive, the price of gasoline actually increased at an annual rate of 24,02% over the year 2010, which was one of the worst years for consumers who drive. However, in 2011, the price of automobiles increased barely at an annual rate of 1.95% over the price in 2010.

Average Inflation Rate

To account for the effect of varying yearly inflation rates over a period of several years, we can compute a single rate that represents an average inflation rate. Since each year's inflation rate is based on the previous year's rate, these rates have a compounding effect. Suppose we want to calculate the average inflation rate for a two-year period. The first year's inflation rate is 4%, and the second year's rate is 8%, with a base price of P1000.00. To calculate the average inflation rate for two years, we employ the following procedure:

- STEP 1: to find the price at the end of the second year, we use the process of compounding.

$$\underbrace{\overbrace{\text{P1000 } (1 + 0.04)}^{\text{First year}} (1 + 0.08)}_{\text{Second year}} = \text{P1123.20}$$

- STEP 2: To find the average inflation rate, we establish the following equivalence equation:

$$\text{P1000 } (1 + f)^2 = \text{P1000, or P1000 } (F/P, f, 2)$$

Solving for f yields

$$f = 5.98\%)$$

Thus, we can say that the price increases in the last two years are equivalent to an average rate of 5.98% per year. Note that the average is a geometric average, not an arithmetic average, over a several-year period. Why do we need to calculate this average inflation rate? If we want to estimate the future prices on the basis of the historical data, it simplifies our economic analysis to have a single average rate such as this rather than a different rate for each year’s price.

Example 1: Calculating an Average Inflation Rate

Consider the price increases for the 11 items in the following table over the last 11 years:

Category	2011 Price	2000 Price	Average inflation rate
Postage	$0.44	$0.33	2.65%
Homeowners insurance (per year)	$674.00	$500.00	2.75%
Autos insurance (per year)	$872.00	$687.00	2.19%
Private college tuition and fees	$27, 293.00	$15, 518.00	5.27%
Gasoline (per gallon)	$3.64	$1.56	8.01%
Haircut	$21.00	$10.50	6.50%
Car (Toyota Camry)	$22, 590.00	$21, 000.00	0.67%
Natural gas (per million BTUs)	$11.99	$3.17	12.86%
Basketball tickets (family of four)	$197.35	$131.88	3.73%
Movies (average ticket)	$7.50	$5.39	3.05%
Health care (per year)	$3, 365.08	$1, 656.00	6.66%
Consumer Price Index (CPI) **Base period: 1982-1984 = 100**	**223.47**	**171.20**	**2.45%**

Source: Table2. Fundamentals of Engineering Economics, Third Edition by: Chan S, Park, pp 163-164

Explain how the average inflation rates are calculated in the table

Dissecting the Problem Let's take the fourth item, the cost of private college tuition, for a sample calculation. Since we know the prices during both 2000 and 2011, we can use the appropriate equivalence formula (single-payment compound amount factor or growth formula)	***Given:*** P = \$15, 518, F = \$27, 293, and N = (2011-2000) = 11 years ***Find:*** f
Methodology *Compute for average inflation rate.*	***Solution:*** We use the equation $F = P(1 + f)^N$ $\$27,293 = \$15,518(1 + f)^{11}$ Solving for f yields $f = 1.7588^{1/11} - 1$ $= 0.05267 = 5.27\%$

	This 5.27% means that the private college tuition has out spaced the overall inflation (2.45%) by 215% over the last 11 years. If the past trend continues into the future, the private college tuition in 2020 may be estimated as follows: Private tuition in year 2020 $= \$27,293(1 + 0.05267)^9$ $= \$43,319$ In a similar fashion, we can obtain the average inflation rates for the remaining items as shown in the table. Clearly, the cost of natural gas increased the most among the items listed in the table.

General Inflation Rate (f_g) versus Specific Inflation Rate (f_s)

When we use the CPI as a base to determine the average inflation rate, we obtain the **general inflation rate**. We need to distinguish carefully between the general inflation rate and the average inflation rate for specific goods:

General inflation rate (f_g): This average inflation rate is calculated on the basis of the CPI for all items in the market basket. The market interest rate is expected to respond to this general inflation rate,

In terms of CPI, we define the general inflation rate as

$$CPI_n = CPI_o (1 + f_g)^n,$$

or

$$f_g = \left(\frac{CPI_n}{CPI_o}\right)^{1/n} - 1,$$

where: f_g = the general inflation rate
CPI_n = the consumer price index at the end period n, and
CPI_o = the consumer price index for the base period

If we know the CPI values for two consecutive years, we can calculate the annual general inflation rate as

$$f_g = \frac{CPI_n - CPI_{n-1}}{CPI_{n-1}} ,$$

where: f_g = the general inflation rate for period n.

As an example, let us calculate the general inflation rate for the year 2011, where CPI_{2010} = 218.0 and CPI $_{2011}$ = 223.50:

$$\frac{223.50 - 218.0}{218} = 0.0252 = 2.52\%$$

This calculation demonstrates that 2011 was an usually good year for the consumers, as its 2.52% general inflation rate is slightly lower that the average general inflation rate of 2.94% over the last 29 years.

Specific inflation rate (*f_s*): This rate is based on a price index (other that the CPI) specific to segment $_s$ of the economy. For example, we often must estimate the future cost for an item such as labor, material, housing, or gasoline. (When we refer to the average inflation rate for just one item, we will drop s for simplicity) All average inflation rates calculated in example 1 are specific inflation rates for each individual price item.

Example 2. Developing Specific Inflation Rate for Basketball Tickets.

The accompanying table shows the average cost since 2005 for a family of four to attend a basketball game. Determine the specific inflation rate, f_s for each period, and calculate the average inflation rate over the six years.

Year	Cost	Yearly Inflation Rate
2005	276.24	
2006	287.84	4.20%
2007	313.83	9.03%
2008	320.71	2.19%
2009	326.45	1.79%
2010	334.78	2.55%
2011	339.01	1.26%

Dissecting the Problem Let's take the fourth item, the cost of private college tuition, for a sample calculation. Since we know the prices during both 2000 and 2011, we can use the appropriate equivalence formula (single-payment compound amount factor or growth formula)	**Given:** History of basketball ticket prices **Find:** The yearly inflation rate and the average inflation rate over the six-year time period.
Methodology Calculate the inflation rate for each year and the average inflation rate over the six-year period	***Solution:*** The inflation rate between year 2005 and year 2006 (f_1) is \$287.84 - \$276.24) / \$276.24 = 4.20% The inflation rate between year 2006 and year 2007 (f_2) is \$313.83 - \$287.84) / \$287.84 = 9.03% The inflation rate between year 2007 and year 2008 (f_3) is \$320.71 - \$313.83) / \$313.83 = 2.19% Continue these calculations through 2009-2011. The average inflation rate over the six years is $f = (\$339.01 - \$276.24)^{1/6} - 1$ $= 0.0347 = 3.47\%$ Note that, although the average inflation rate is 3.47% for the period taken as a whole. None of the years within the period had this rate.

UNEMPLOYMENT AND INFLATION

ROLE OF INTEREST RATES

Interest rates, adjusted for inflation, rise and fall to balance the amount saved with the amount borrowed, which affects the allocation of scarce resources between present and future uses.

An interest rate is the price of money that is borrowed or saved.

- Like other prices, interest rates are determined by the forces of supply and demand.
- The real interest rate is the nominal or current market interest rate minus the expected rate of inflation.

The interest rate is the opportunity cost of holding money, because instead of holding money, people could hold interest-earning assets (such as Certificates of Deposit or bonds) instead. Interest rates are determined by the interaction of lenders who supply funds, and borrowers, who demand funds.

- Savers supply funds to be loaned and are paid interest for waiting to consume at a later date.
- Demanders of these funds are the borrowers, who pay interest in order to have the right to spend now instead of waiting for future income. This spending might be on consumption or on investment goods (such as plant and equipment).
- Interest rates vary with the type of market. Rates change within a market in response to changes in supply and demand for loanable funds.

SUMMARY:

Inflation is a general increase in the level of prices throughout the economy. Is a term used to describe a decline in purchasing power evidenced in an economic environment of rising prices

- The most commonly used measure of inflation is the Consumer Price Index, (or CPI). The CPI compares the cost of a sample "market basket" of goods and services in a specific period with the cost of the same market basket in an earlier reference period. This reference period is designated as the base period. Changes in these price indices indicate changes in the purchasing power of the money.
- Unanticipated inflation alters the normal signals buyers and sellers receive from prices, changing their behavior in markets.
- Inflation encourages more debt and faster spending as buyers and sellers try to avoid rising prices.
- Inflation creates uncertainty and makes future planning more difficult.
- Unanticipated inflation erodes the purchasing power of nominal assets, including money, bonds, and savings accounts. Individuals with fixed incomes also lose.
- Very rapid inflation (a/k/a hyperinflation) causes markets of all types to break down, for two reasons.
- The extremely high cost of using money during hyperinflations forces people to resort to barter, which is an inefficient means of transacting.
- A high average rate of inflation is always accompanied by much *uncertainty* about the future inflation rate, which makes many contracts more risky. Greater levels of risk increase the value of the "option to wait," which delays many consumption and investment decisions, and thereby slows economic growth.

Inflation is a monetary phenomenon, and almost always occurs because increases in the stock of money exceed growth in output of goods and services.

- Rapid increases in the money supply can be the result of poor management by the central bank or by a decision to print money to support government spending.
- A frequent problem in developing nations is that governments without stable or consistent tax collections often resort to printing money to finance government spending.
- Inflation increases pressure on government to impose price controls which tends to make conditions worse instead of better.
- Intended to halt rising prices, price controls instead disguise inflation and disrupt the allocation of goods and services.

III. PROGRESS CHECK

1. An engineer's salary was P50, 000.00 in 2006. The same engineer's salary in 2011 is P80, 000.00. If the company's salary policy dictates that a yearly raise in salaries reflect the cost of living increase due to inflation, what is the average inflation rate?
2. How many years will it take for the peso's purchasing power to be one-third what it is now, if the general inflation rate is expected to continue at the rate of 7% for an indefinite period?

IV. REFERENCES

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MIDTERM COMPREHENSION CHECK

I. MULTIPLE CHOICE: Write the correct letter of your choice before the number. Show solutions to numbers with problem solving.

1. If the nominal rate is compounded annually, then
   A. Nominal rate is less than effective rate C. nominal rate is equal to the effective rate
   B. Nominal rate is higher than effective rate D. none of these

2. The term used to express the series of uniform payments occurring at equal interval of time is.
   A. compound interest B. Annuity C. Perpetuity D. Amortization

3. It consists of the cost of the wages of all office staff, postage, legal expenses, depreciation of office equipment, etc.
   A. Work overheads B. Indirect cost C. Office overheads D. Sales Overheads

4. It is called the length of time between the origin and the maturity dates.
   A. Period of the loan B. Term of the loan C. Duration of the loan D. Loan Expiration

5. It is called when the interest is compounded more than once a year.
   A. Effective rate B. Nominal rate C. Interest rate D. Compounded interest rate

6. A visual representation of cash inflows and outflows along a timeline.
   A. Cash flow graph B. Cash flow diagram C. Cash presentations D. Cash diagram

7. A market situation where there are one seller and many buyers.
   A. Monopoly B. Monopsony Perfect Competition D. Bilateral monopoly

8. Is the practice of charging an interest rate only to an initial sum?
   A. Charge Interest B. Compound Interest C. Simple Interest D. Interest rate

9. Is the practice of charging an interest rate to an initial sum and to any previously accumulated interest that has not been withdrawn from the initial sum?
   A. Charge Interest B. Compound Interest C. Simple Interest D. Interest rate

10. Is the amount of a product made available for sale?
    A. Supply B. Demand C. Need D. Item

II. PROBLEM SOLVING: Read, analyze, draw your cash flow diagram and solve what is asked. Show your solution.

1. Budjanga, a business man wants to have P500, 000.00 four (4) years from now. What amount should he invest now if it will earn an interest of 6% compounded quarterly for the first two years and 8% compounded semi-annually during the next 2 years?

2. You are considering investing P4, 000, 000.00 at an interest rate of 5% compounded annually for five years, or investing P4, 000, 000.00 at 6% per year simple interest for seven years. Which option is better? *(Prove with mathematical solution).*