

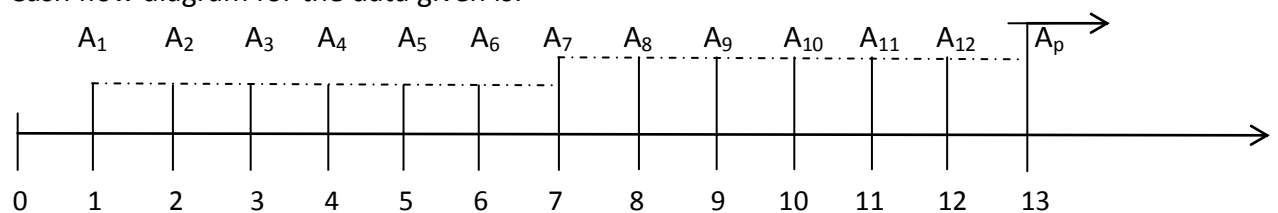
How much money should be invested today at 16% interest rate, that can provide the following scholarships:

- P30,000 at the end of each year for 6 years, P40,000 for the next 6 years, and P50,000 thereafter? Show the cash flow diagram.

### Solution

In our case scholarship is a typical example of ordinary annuity for the first 12 years, and perpetuity for the next years. Ordinary annuity means that cash flows are received at the end of each period. And perpetuity is an annuity that has no end, or a stream of cash flows that continues forever.

Cash flow diagram for the data given is:



$$A_1 = A_2 = A_3 = A_4 = A_5 = A_6 = P\ 30,000$$

$$A_7 = A_8 = A_9 = A_{10} = A_{11} = A_{12} = P\ 40,000$$

$$A_p = P\ 50,000$$

In order to find out how much money should be invested today, we should calculate today's value of ordinary annuity. If we need to determine today's value of a series of future payments, we need to use the formula that calculates the present value of an ordinary annuity:

$$PV_{\text{ordinal annuity}} = A * \left[ \frac{1 - (1 + i)^{-n}}{i} \right]$$

A = cash flow per period

i = interest rate

n = number of payments

Using this formula we can determine present value of the series of cash flows for the first 6 years.

The present value of the first six cash flows is:

$$PV_{1-6} = 30,000 * \left[ \frac{1 - (1 + 0.16)^{-6}}{0.16} \right] = 110,542.1$$

We can find the present value of the next six cash flows, but with the formula given we will find the PV of cash flows at the end of sixth year. In order to calculate this value for the beginning of the first year we need to discount this value.

$$PV_{7-12} = 40,000 * \left[ \frac{1 - (1 + 0.16)^{-6}}{0.16} \right] * \frac{1}{(1 + 0.16)^6} = 60,494.85$$

We can calculate the present value for perpetuity using formula:

$$PV_{perpetuity} = \frac{A_p}{i}$$

$$PV_{perpetuity} = \frac{50,000}{0.16} = 312,500$$

The amount of money, which should be invested now, is the present value of all ordinary annuity and perpetuity.

$$PV = PV_{1-6} + PV_{7-12} + PV_{perpetuity} = 110,542.1 + 60,494.85 + 312,500 = 483,536.95$$

**Answer:** The amount of P 483,536.95 should be invested today to provide scholarship given.