

# Challenge: Your Monthly Savings Plan According to Your Age with Interest Rate

In this Python programming challenge, you will create a personal monthly savings plan based on a user's age, taking into account the interest rate on their invested savings. By using Python operators, you will determine the ideal savings amount according to the user's age, financial goals, and interest rate. This challenge will showcase the practical applications of Python operators in the realm of personal finance.

## Challenge:

Your goal is to create a program that calculates the ideal monthly savings amount based on the user's age, target retirement age, desired savings amount at retirement, and an annual interest rate. To accomplish this, you will use Python operators and the following steps:

- Prompt the user for their current age.
- Prompt the user for their target retirement age.
- Prompt the user for their desired savings amount at retirement.
- Prompt the user for the annual interest rate on their savings.
- Calculate the number of years left until retirement.
- Calculate the total number of months left until retirement.
- Determine the ideal monthly savings amount based on the desired savings, the number of months left until retirement, and the interest rate.
- Display the ideal monthly savings amount to the user.

Discover the capabilities of Python operators in personal finance! Good luck!

## Tip 1 - Net Present Value

The Net Present Value (NPV) formula is a financial metric used to determine the value of an investment by calculating the sum of the present values of all expected cash flows over the life of the investment. NPV is used to analyze the profitability of an investment, and it helps investors make informed decisions about whether to proceed with a project or investment.

**The NPV formula is:**  $NPV = \sum (CF_t / (1 + r)^t) - I$

where:

- NPV: Net Present Value
- $CF_t$ : Cash flow at time period  $t$
- $r$ : Discount rate (or required rate of return)
- $t$ : Time period
- $I$ : Initial investment cost

The NPV formula consists of two main components:

1. **The sum of the present values of all expected cash flows:** This component calculates the present value of each cash flow by dividing it by the factor  $(1 + r)^t$ , where  $r$  is the discount rate and  $t$  is the time period. The discount rate represents the time value of money, which takes into account the concept that a dollar today is worth more than a dollar in the future. By discounting each cash flow to its present value, we can compare the value of cash flows at different points in time on a consistent basis.
2. **The initial investment cost:** This component represents the cost of the investment or project at the beginning. It is subtracted from the sum of the present values of all expected cash flows to determine the net value of the investment.

A positive NPV indicates that the investment is expected to generate more value than its cost, making it a potentially profitable investment. Conversely, a negative NPV suggests that the investment is expected to result in a net loss, making it an unattractive option. An NPV of zero indicates that the investment will generate just enough value to cover its cost, resulting in a break-even scenario.

It's important to note that the NPV calculation relies on accurate estimates of future cash flows and an appropriate discount rate, both of which can be subject to uncertainties and assumptions. As a result, NPV should be used in conjunction with other financial metrics and qualitative factors when making investment decisions.

## Tip 2 - Creating the monthly savings formula explanation

Here is a detailed breakdown of the formula used to calculate the ideal monthly savings amount:

$$\text{monthly\_savings} = (\text{desired\_savings} * \text{monthly\_interest\_rate}) / ((1 + \text{monthly\_interest\_rate}) ** \text{months\_until\_retirement} - 1)$$

- **desired\_savings:** This is the future value of the annuity, which represents the desired savings amount at retirement as provided by the user.
- **monthly\_interest\_rate:** This is the interest rate per month calculated from the annual interest rate. It is calculated using the formula:  $(1 + \text{annual\_interest\_rate} / 100) ^ (1 / 12) - 1$ . This formula converts the annual interest rate to its equivalent monthly interest rate.
- **months\_until\_retirement:** This is the total number of months left until retirement, calculated by multiplying the number of years left until retirement by 12.

Now, let's break down the formula:

- **$(1 + \text{monthly\_interest\_rate}) ** \text{months\_until\_retirement}$ :** This part of the formula calculates the compound interest factor. It represents the total growth of the investment over the entire savings period.
- **$((1 + \text{monthly\_interest\_rate}) ** \text{months\_until\_retirement} - 1)$ :** By subtracting 1 from the compound interest factor, we isolate the total interest earned over the entire savings period.
- **$(\text{desired\_savings} * \text{monthly\_interest\_rate})$ :** This part of the formula calculates the product of the desired savings at retirement and the monthly interest rate. This represents the total interest earned over the entire savings period, adjusted by the desired savings amount.
- **$(\text{desired\_savings} * \text{monthly\_interest\_rate}) / ((1 + \text{monthly\_interest\_rate}) ** \text{months\_until\_retirement} - 1)$ :** Finally, we divide the adjusted total interest earned by the isolated total interest earned over the entire savings

period. This gives us the ideal monthly savings amount that the user needs to save in order to reach their desired savings goal at retirement.

By calculating the ideal monthly savings amount using the future value of an ordinary annuity formula, we can provide the user with a practical and accurate estimate of how much they need to save each month to achieve their retirement goals, taking into account the power of compound interest.

