

Table of Contents

1	INTRODUCTION.....	1
2	PRE-REQUISITES.....	2
3	INSTALLATION/REMOVAL	2
4	USE.....	2
4.1	REGISTER.....	3
4.2	LANGUAGE	4
4.3	PRINCIPAL NEEDED.....	5
4.4	INITIAL ANNUAL INCOME	7
4.5	YEARS UNTIL RUNOUT	8
4.6	INVESTMENT RETURN.....	9
4.7	FINE DETAILS.....	11
4.7.1	<i>Simple Interest Rate (SIR)</i>	12
4.7.2	<i>Annual Effective Return (AER)</i>	13
4.7.3	<i>Discounted Cash Flow (DCF)</i>	13
4.7.4	<i>Forward Discount Model (FDM)</i>	14
4.8	SAVE.....	15
5	ALTERNATIVE USES	16
5.1	ANNUITY CALCULATIONS.....	16
5.2	MORTGAGE CALCULATIONS.....	16

1 Introduction

This is a manual for the installation and use of the application 'AccountancySoftware'. The program is a Windows application, aimed at households, accountants, financial planners etc. for planning for retirement and administrating your wealth. It would also be suitable for people in other roles than this, possibly not with ready access to financial advice (perhaps because of its

cost or their circumstances). The program does not have regulatory approval (if indeed this exists for such software) and will not replace the legal obligation, in some jurisdictions, to obtain (implying pay for, what are often significant amounts) financial advice, before embarking upon major financial decisions. However, I (c/o Mathematical Services Limited) have used it successfully to make my own financial decisions on such matters, and it is this personal and corporate endorsement which a user can trust.

2 Pre-requisites.

1. A PC running Windows 7 or above.
2. A USB stick or optical disc containing the program setup files, together with this manual (available online).

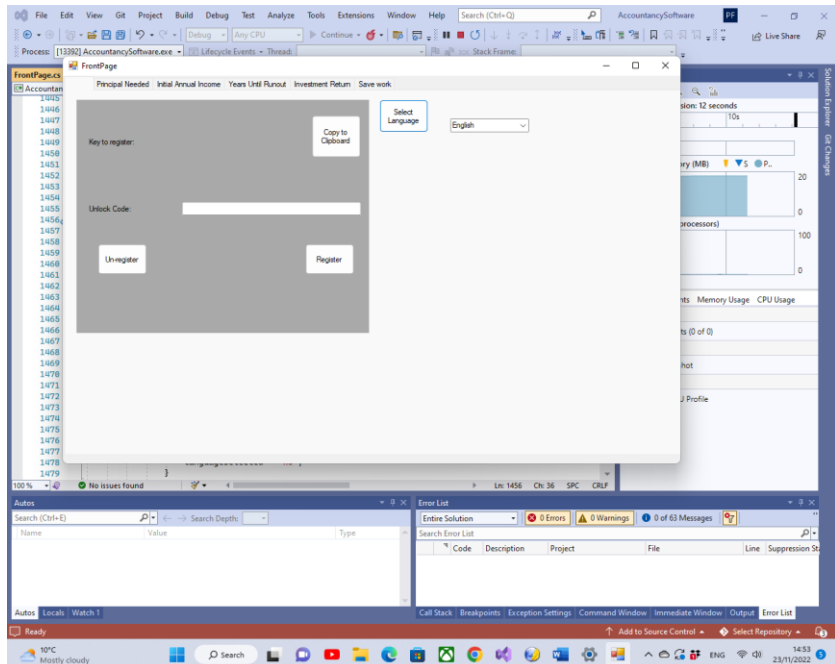
3 Installation/Removal

Insert the supplied stick into the PC and run the 'setup.exe' program. The program can be removed from the PC, by using the 'Program & Features' menu from within Control Panel.

4 Use

The application has 8 tabs:

4.1 Register

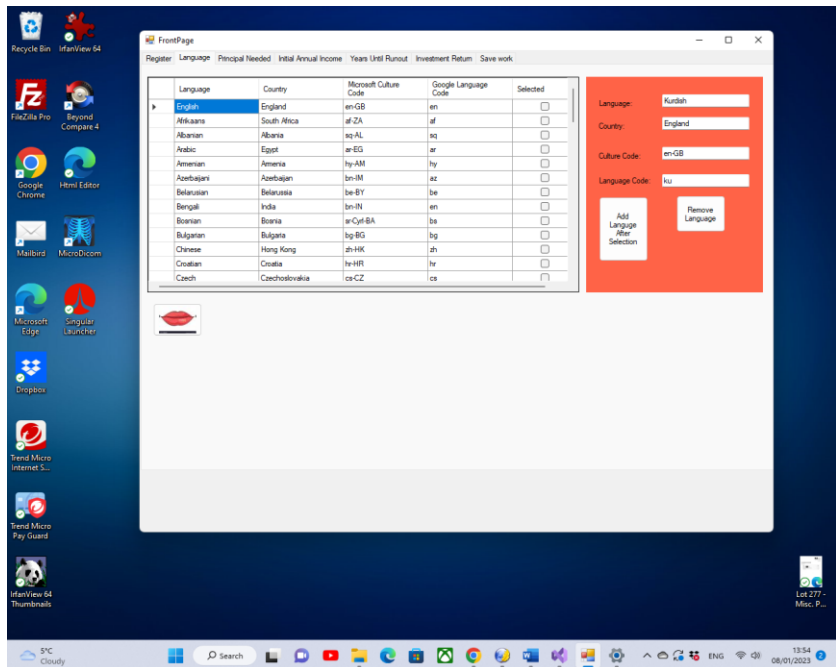


Before this application can be used on a device it must be registered on the device. This is the role of the controls on the left-hand panel.

The presented key to register must be sent to 'paulfoy@mathematicalservices.co.uk'. It can be copied using the 'Copy To Clipboard' button. In return you will be sent an unlock code, which is unique to that device. On inserting that into the textbox the application is registered using the 'Register' button.

The application can be unregistered by using the 'Un-register' button. The application cannot then be used on the same device until it is re-registered (which can be done using the same unlock key).

4.2 Language



It is possible to select the working language of the application. The attributes of this language are the Country, the Language, the Microsoft Culture Code (see the Microsoft documentation), and the Google Language Code (see Google's documentation).

The button **Add Language After Selection**, adds the attributes of a new language, after the one selected. The button **Remove elected Language** removes the selected language as a possibility of a working language for the application.

4.3 Principal Needed

FrontPage
Register | Language | Principal Needed | Initial Annual Income | Years Until Retirement | Investment Return | Fine Details | Save work

Years Until Death: 10
InvestmentReturn: -5.5
Rate of Inflation: 0
Initial Annual Income: 7561.87
Years Until Retirement: 0
Initial Annual Pension Income: 0

Calculate Principal Required

1st parameter range: 5000 to 15000
2nd parameter range: 5 to 55
Contour Plot
InvestmentReturn/AnnualIncome

09:51
18/08/2024

You may enter values in each of the 6 text boxes.

The last choice made is automatically presented to you. If this has not been previously chosen you may supply it, either via selecting it or typing it in.

- i. **Years Until Death:** Your estimate of how long you have got to live in years.
- ii. **Investment Return:** Your expected annual rate of growth of your investments, as you manage them, going forward, until your death.
- iii. **Rate of Inflation:** An estimate for the expected annual rate of inflation, going forward, until your death.
- iv. **Initial Annual Income:** Your desired initial annual income as you draw on your capital, going forward. This

figure will assume to increase annually, in real terms, according to the rate of inflation.

- v. **Years Until Retirement:** Your estimate of how many years before you plan to retire, and then draw on any pension income outside of these calculations, such as a State Pension or a past employer's pension.
- vi. **Initial Annual Pension Income:** Your initial annual pension income, from sources outside of these calculations, as described previously. This figure will assume to increase annually, in real terms, according to the rate of inflation.

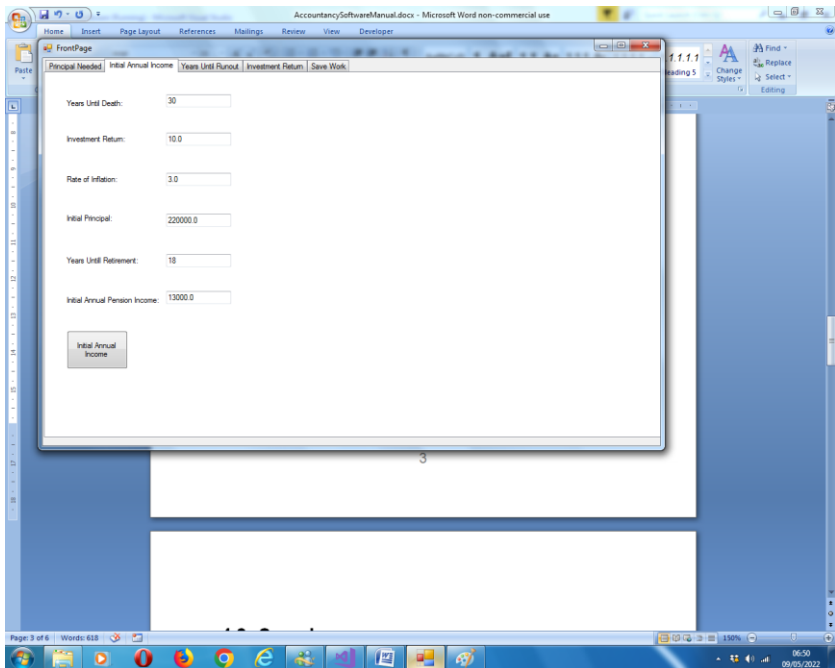
The button presented allows a calculation of the initial principal which it will be necessary to have, in order that you do not run out of money, before you die. The calculations assume that you have no money left at the time of death.

The panel on the right-hand side allows you to see contour plots of the principal needed either with:

1. Investment Return against Annual Income
2. Investment Return against Years Until Death
3. Annual Income against Years Until Death

The ranges of the first and second parameter are given in the text boxes in this panel. The range of 'Years Until Death' is an integer. Values other than the two parameters of the ranges are given by the text boxes on the left hand side.

4.4 Initial Annual Income

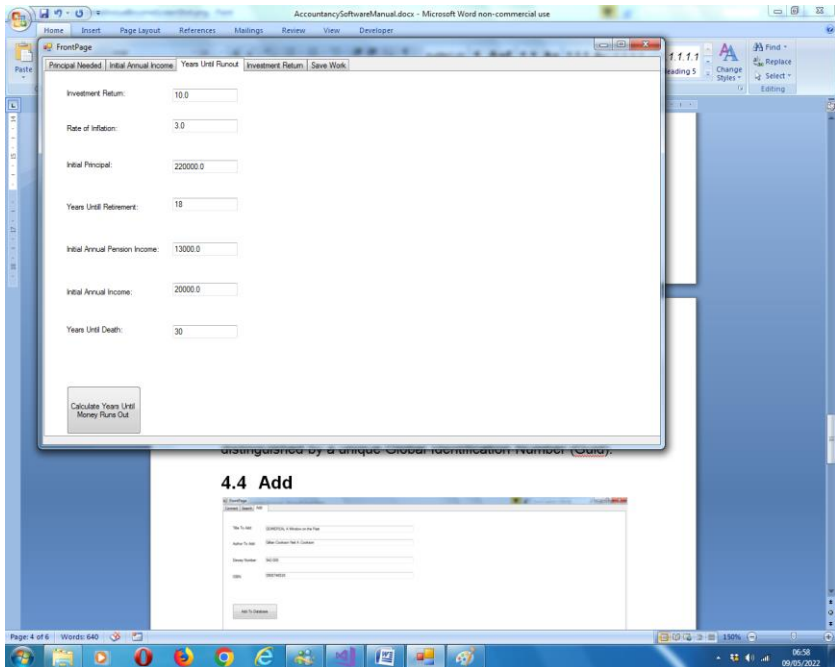


The new field in this tab is:

- i. **Initial Principal:** This is your starting resource, which you will draw on, according to the assumptions made, until you die.

The button supplied allows you to calculate the initial annual income which you can expect, adjusted for the rate of inflation, going forward.

4.5 Years Until Runout



The supplied button allows you to calculate how long your resources will last, in years, according to the assumptions provided. It is possible to include a pension income beginning concurrently or at a set point in the future. Both the pension income and the annual income (from investments of the principal) are assumed to appreciate according to the rate of inflation.

4.6 Investment Return

FrontPage

Register | Language | Principal Needed | Initial Annual Income | Years Until Runout | Investment Return | Fine Details | Save work

Year	Amount
1	7361.87
2	7361.87
3	7361.87
4	7361.87
5	7361.87
6	7361.87

Investment return: 0.5

Calculate Final Principal

Current value: 100000

Calculate AER

Current (Redemption) Value: 100000

Time Period (years): 10

Initial Value: 10000.0

Calculate AER

AER: 0.5

Calculate Yearly Investment

09:53 18/08/2024

This tab allows you to:

In the right-hand panel:

Top panel: Calculate the performance (AER) of a sum invested from an **Initial Value** to a **Current/Redemption Value**, over a **Time Period** of years.

Bottom panel: Calculate the yearly investment that over a period of the **Time Period** of years at the provided **AER** will amount to the **Current/Redemption Value**. The model assumes the investment is made at the start of the year and accumulates during the full course of the year.

In the left-hand panel:

- i. Monitor the performance of your capital, over a period of several years, from a savings regime.
- ii. Calculate the capital accrued, over a period of several years. You may enter the total invested each year in the data grid (a minimum of 2 years).

The text boxes, in the left-hand panel supplied are:

- i. **Current Value:** This is the current total value of your investments.
- ii. **Investment return.** This is the return on capital (in percent) for the duration of the savings regime.

The button **Calculate AER** allows you to calculate the effective annual percentage interest rate, over the lifetime of the investments (deduced from the number of rows in the table), based upon the investments and the current total value.

The button **Calculate Final Principal** allows you to calculate the final amount accrued by the investment.

The model employed in each case is an investment made at the start of the year which accumulates interest for the entire year. So, on the last year there is one full year of interest to add.

The text boxes, on the right-hand side are:

- iii. **Current/Redemption Value:** This is the current total value of your investments, or the redemption value of say a gilt.
- iv. **Initial Value:** The starting value or current price of a gilt.
- v. **Time Period:** The time of the investment in years.

The button supplied allows you to calculate the effective annual percentage interest rate, over the lifetime of the investment.

4.7 Fine Details

FrontPage
Register | Language | Principal Needed | Initial Annual Income | Years Until Runout | Investment Return | Fine Details | Save work

Investment date: 15 January 2024
Investment Amount: 100.5
End date: 8 August 2025
End amount: 100.00

Max End Amount: 110.0
Min End Amount: 90.0
No. of Coupons: 80
Contour plot

Bond:

Coupon 1: 7 March 2.5
Coupon 2: 7 September 2.5
Coupon 3: 31 December
Coupon 4: 31 December

Calculate assessment
Assessment type: SIR
Discount Rate (%): 5.5

Equity:

Day	Month	Year	Amount
7	December	2023	3.0
7	June	2024	0.0
7	December	2024	0.0
7	June	2025	0.0
7	December	2025	0.0
7	June	2026	0.0

Security Selection: Bond
 Include accrued interest SIR (bond only)

The left-hand sub-panel permits the detailed assessment of the potential of a fixed income security or bond like investment. That is one which is bought on a certain date, for value I , and expires (or is sold) at a certain date in the future, for value F . Meanwhile up to four fixed coupons (or dividends) are paid out at regular intervals, having value C_i , $1 \leq i \leq 4$.

The right-hand panel permits the detailed assessment of any other security, also bought on a certain date, for value I , and redeems (or is sold) at a certain date in the future, for value F . Such a security would be an equity where the dividend, C_i , is neither fixed in time, frequency, or amount.

The type of security is selected by the combo box, **Security selection**, in the middle below the two panels.

Four metrics of these investments are provided via the combo box on the right of **Calculate assessment** button.

The top right panel and the button **Contour plot** enables a plot of contours of the calculation of the APR (see metric described in 4.7.1) when the gilt of the top left-hand panel is redeemed (sold) at any time up to the end date at any redemption price. That is, the contours are two-dimensional graphs of redemption price against time of regions of a fixed APR. The number of contours can be specified as can the Y-axis range of redemption prices. The X-axis range is specified by the start and end dates of the investment. The nature of the graph once plotted can be altered using the menus in the plot window displayed. A recommended number of contours (**No. of Contours**) is 80. The values **Max End Amount** and **Min End Amount** must bear some relation in value to the **End Amount** provided at the left-hand side.

The feature is useful in helping you decide if it is more advantageous to sell now or later if you have a view or some insight into the movement of the gilt redemption price (its current value). The contours may be plotted either with or without accrued interest (see 4.7.1).

This tool is courtesy of the products (Matrix dll) available elsewhere on www.mathematicalservices.co.uk.

In the following descriptions of the metric the terms coupon will be synonymous with dividend.

4.7.1 Simple Interest Rate (SIR)

This is the quantity:

$$100.0 * \frac{(F + \sum_{i=1}^4 \sum C_i - I)}{I * T}$$

Equation 4-1

where T is the time between buying and selling, and the inner sum indicates that the coupon C_i may be paid out multiple times during the intervening period. This is the simplest measure and the one most often used.

With this selection there is the option of including the accrued interest in the calculation of the SIR. This is the interest accrued proportionally by the gilt between coupon dates. It is subtracted from the purchase and added to the sale. Accrued interest is often included on purchase and sale of government gilts but not corporate bonds. This option is selected by the checkbox on the right-hand side.

4.7.2 Annual Effective Return (AER)

This is compound interest rate – it returns x in the equation:

$$\left(F + \sum_{i=1}^4 \sum C_i \right) = Ix^T$$

Equation 4-2

as a percentage. It is a more exacting measure of the return in that it makes an equivalence between an investment which continually returns interest (and accrues from this) rather than periodically.

4.7.3 Discounted Cash Flow (DCF)

This metric values the investment via the return you would hope to get from your capital. It 'discounts' future coupons in proportion to the discount rate r , as though, say, future returns are eroded by inflation or by what could be obtained by another investment. If the return from this metric is greater than the discount rate, r , provided then the investment is a valued one.

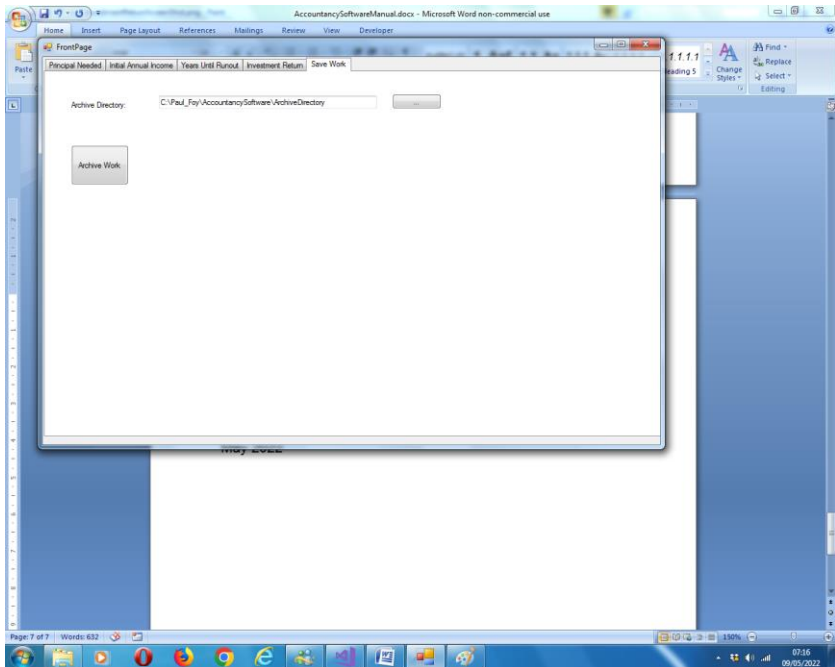
The metric is $\frac{(F + \sum_{i=1}^4 \Sigma C'_i)}{I * T}$ where C'_i are the 'discounted' coupons, given by $\frac{C_i}{1.0 + \frac{\tau}{T}}$ where τ is the duration of an individual coupon.

4.7.4 Forward Discount Model (FDM)

This is the most exacting of the metrics. It calculates the AER of each coupon as a return of $I + C_i$ on capital of I over the time between investment and the coupon being paid (using Equation 4-2). Then together with the investment of F from I over time T the return is the average of these investments.

Because a fixed income security such as a government gilt, generally redeems at the issue price (usually 1 or 100 say) this gives a poor view of the investment because when held until maturity there is generally no capital appreciation. It has a pessimistic view of a long-term investment, more so than that of the DCF metric. However the metric has its value in highlighting an appreciating asset such as an equity.

4.8 Save



This tab allows an archive directory to be selected, where the program, will save its parameters, for the convenience of the user. This is predominantly the information in the data grids of the previous two tabs.

There is also an **'About'** button permitting you to see information about your software.

5 Alternative Uses

The software may be configured to perform alternative calculations than the ones explicitly described by populating the text boxes of the tabs in various ways:

5.1 Annuity Calculations

Using the 'Principal Needed' tab the 'value for money' of an annuity quote by an Insurance Company may be sought. The '**Years Until Death**' is your life expectancy. The '**Investment Return**' is the return you think the Insurance Company as a professional investor can achieve. The '**Rate of Inflation**' is zero if it is a level annuity and the escalation for an inflation adjusted annuity. The '**Initial Annual Income**' is the starting pension (fixed throughout if it is a level annuity). The other two fields are set at zero. The '**Principal Needed**' should then be compared with the Insurance Company's quote.

For example, purchasing a level annuity for £174,000, should provide a 58-year-old male (average life expectancy is 26 years in UK) an annual income of £12,700 (assuming the Insurance Company can achieve an investment return of 5.5%).

5.2 Mortgage Calculations

Using the 'Years Until Runout' tab the time you will take to pay off an amount of money borrowed for a house may be sought. The '**InvestmentReturn**' is set at the mortgage interest rate (payable to the lender). The '**Initial Principal**' is set at the amount of the loan (the amount borrowed). The '**Initial Annual Income**' is set at the yearly amount that you intend to pay of the mortgage (i.e. the capital and any interest payments) The '**Years Until Retirement**' and '**Years until Death**' are set at unreasonably large values so they do not appear in the calculation. The '**Rate of Inflation**' (assuming all the money is used to buy a house and becomes 'dead' capital) and the '**Initial**

Annual Pension Income are set to 0.0. Then the 'Years Until Money Runs Out' button gives the time needed to clear the debt.

For example, borrowing £174,000, at an interest rate of 5.5% and paying of £12,700 per year will take approximately 26 years to clear the debt. Interestingly the amount of money you have had to find to service this debt is approximately £330,200.

Paul D. Foy
Mathematical Services Limited

August 2024