Currencies

Country	Main currency unit	Sub-division
United Kingdom	Pound (£)	Pence (£1 = 100p)
United States	Dollar ($)	Cent ($1 = 100¢)
European Union	Euro (€)	Cent (€1 = 100¢)
Japan	Yen (¥)	–

Question 1.1

Today's exchange rates are shown as:

$$€/£ = 0.61 \text{ and } £/\$ = 1.44$$

How much would 1,000 Euro be worth in US dollars?

Dates

Gregorian calendar

The calendar system used in Western Europe and America is officially called the Gregorian calendar (named after Pope Gregory XIII who introduced it). This system is recognised and understood worldwide, although a number of countries in other parts of the world have alternative calendar systems that they use as well.

Leap years

Calendar years usually have 365 days but, in order to prevent the seasons gradually drifting, an extra 'leap' day is added at the end of February in some years. These leap years have 366 days, the extra day being 29 February. The general rule for determining whether a particular calendar year is a leap year is as follows:

LEAP YEAR OR NOT?

A calendar year **IS NOT** a leap year …

… unless it divides exactly by **4**, in which case it **IS** a leap year …

… unless it also divides exactly by **100**, in which case it **IS NOT** a leap year …

… unless it also divides exactly by **400**, in which case it **IS** a leap year!

Question 1.2

In actuarial calculations involving weekly payments it is often assumed that there are 52.18 weeks in an 'average' year. Where does this figure comes from?

In a lot of actuarial applications the exact number of days in each month makes very little difference to the numerical answers. In these cases you can assume that the months are of equal length *ie* each month is exactly $\frac{1}{12}$ of a year long. This simplifies the calculations considerably.

Calendar years, quarters and tax years

Many organisations divide each calendar year into four quarters for budgeting and accounting purposes. For example, the calendar year 2018 would be broken into the four quarters:

> 2018 Q1:   1 January 2012 – 31 March 2012

> 2018 Q2:   1 April 2012 – 30 June 2012

> 2018 Q3:   1 July 2012 – 30 September 2012

> 2018 Q4:   1 October 2012 – 31 December 2012

In actuarial calculations where payments are made quarterly it is normally sufficiently accurate to assume that each quarter is exactly $\frac{1}{4}$ of a year long.

In the UK the amount of tax payable by individuals is calculated based on the transactions during each tax year (sometimes also referred to as a 'fiscal' year), which run from 6 April to 5 April. So, for example, the 2018/19 tax year is the period from 6 April 2018 to 5 April 2019 (both days inclusive). The actual dates will differ between countries, for example the New Zealand tax year runs from 1 April to 31 March.

Fencepost errors

Question 1.3

Two farmers have a pile of 50 cm long strips of wood and wants to erect a fence. They do this by using single strips held horizontal atop of vertical fence posts at each end of the strip. How many vertical posts will they need to make a fence 10 metres long in total?

If you got the answer wrong, you'll see that it's very easy to make these fencepost errors. It's particularly easy to make a mistake in calculations involving dates. Almost everyone gets one wrong at some point.

Question 1.4

(i)   Five payments are made at 9-month intervals with the first payment on
        1 January 2018. On what date will the last payment be made?

(ii)   A man was born on 9 September 1960. In New Zealand, how many <u>complete</u>
        tax years are there between 1 May 1998 and his 60th birthday?

(iii)   How long is the period from 1 March 2025 to 28 February 2025?

Conventions for writing dates

To save time, dates are often written in numbers, rather than in words. So make sure you know the numbers of the months (*eg* October = 10, November = 11).

Also, just to make life difficult, there are two different conventions in use.   In the UK and Europe we use the DD/MM/YY order, whereas Americans use MM/DD/YY. This can cause a lot of confusion since 01/11/18 would mean 1 November 2018 in the UK, but 11 January 2018 in the US. (The reason for this discrepancy is that in the UK we tend to say 'the first of November', whereas in the US they tend to say 'November one'.) To decide which convention is being used, look which position contains numbers greater than 12. This must be the days bit.

In actuarial symbols a fixed period of time is represented by using a right-angle symbol, so that '5 years', for example, is usually represented by $\overline{5|}$. Some of your actuarial colleagues may use this as a shorthand notation. For example, they might write: 'The pension incorporates a $\overline{5|}$ guarantee' or they might even use $\overline{3/_{12}|}$ as an abbreviation for '3 months'.

Ages

In life insurance work and pensions work, you'll often have to work out people's ages. This might sound easy, but there are actually three different ways commonly used to express ages:

Age last birthday: This is the age one of your friends would tell you if you asked them how old they were. It's just the number of candles they had on their last birthday cake.

Age nearest birthday: This is the person's age at their nearest birthday (which could be either the previous one or the following one). Pension fund calculations usually use this definition because, for a large group of people, age nearest birthday usually averages out at the true age. You'll get some people who are slightly older and some who are slightly younger, and these will normally balance out. However, age last birthday will always understate the true age.

Age next birthday: This is the person's age at their next birthday. This definition is the one usually used by insurance companies. This will always overstate the age.

These age definitions are often abbreviated to 'age last', 'age nearest' and 'age next'.

You may hear people in life offices referring to their policyholders as 'a female aged 50 next' (say).

Some people are born on one of the 'leap days' *eg* 29 February 2018. For calculation purposes they are normally treated as if they were born on the following day *ie* 1 March 2018 in this example.

Question 1.5

A man was born on 6 May 1959. What will his age be on 1 January 2020 using each of these three age definitions?

Solutions

Solution 1.1

1,000 Euro must be equivalent to $1,000 \times 0.61 = £610$.

£610 must be equivalent to $610 \times 1.44 = \$878.40$.

The precise rules that banks have to use for converting currencies when Euro are involved are actually quite complicated *eg* you have to work to 6 decimal places.

Solution 1.2

It's $365\frac{1}{4} \div 7$ (rounded to 2 DP).

Solution 1.3

21

The 'obvious' answer was to divide 10 by 0.5 and say 20. But, because you need a post at each end of the fence, you actually need an extra one.

If you said 20, you've made a 'fencepost error'. To avoid these, you need to pay careful attention to which, if either, of the endpoints is included. This problem comes up when you are trying to work out the number of payments in a stream of payments.

Solution 1.4

(i)   1 January 2021 (There are 4 gaps of 9 months between these 5 payments. This makes a total period of 36 months, which equals 3 years.)

(ii)   21 (The period from 1 April 1999 to 31 March 2020 consists of 21 complete tax years *ie* 1999/2000, 2000/01, ... , 2019/20.)

(iii)   10 years (When you're dealing with a <u>period</u> of time, it's a straight subtraction.)

Solution 1.5

Age last = 60 (because his last birthday would be 6 May 2019 and $2019 - 1959 = 60$).
Age next = 61 (add 1 to his age last).
Age nearest = 61 (because his nearest birthday would be 6 May 2020).