

Calculating the age of a person (Berechnung des Alters)

Stand: 19.10.20

Jahrgangsstufe	Lernbereich 2: Modul 2.2.1
Fach/Fächer	Informationstechnologie Bilingualer Zug
Übergreifende Bildungs- und Erziehungsziele	Medienbildung, Digitale Bildung
Zeitraumen	3 - 4 Unterrichtsstunden (ohne Zusatzaufgaben)
Benötigtes Material	<ul style="list-style-type: none"> • Tabellenkalkulationsprogramm, • evtl. Programm zur Erstellung eines Datenflussdiagramms (z. B. Orinoco)

Kompetenzerwartungen

Basic Skills

Grundlegende Kompetenzen

The students ...

analyse simple tasks (e.g. age calculation) in order to solve these with a spreadsheet application (and illustrate the data with appropriate diagrams.)

analysieren einfache Aufgaben (z.B. Berechnung des Alters), um diese mit einem Tabellenkalkulationsprogramm zu lösen (und veranschaulichen die Daten mit geeigneten Diagrammen.)

ICT 2.2. Process-orientated Skills IT 2.2. Prozessbezogene Kompetenzen

Visualizing, interpreting

Darstellen, interpretieren

The students ...

create data in form of spreadsheets to visualize information. They use adequate data types and formats.

erstellen Daten in Form von (...) Tabellen (...) zur Veranschaulichung von Informationen. Sie verwenden für die Speicherung von Daten passende Datentypen und Dateiformate. (...)

The students

(...) in addition to that acquire sustainable skills in fields of fast and secure data input and follow the subject specific rules and design principles while implementing

(...) erwerben darüber hinaus nachhaltige Kompetenzen im Bereich der schnellen und sicheren Dateneingabe und beachten bei der Darstellung von Informationen fachspezifische Regeln (...) und Gestaltungsprinzipien.

Analysing, modelizing, implementing Analysieren, modellieren, implementieren

The students ...

analyse tasks and problems by developing proposals for solution and discuss by means of models (e.g. data flow diagram) computer based implementation possibilities.

analysieren Aufgaben- und Problemstellungen, indem sie Lösungsvorschläge entwickeln und anhand von Modellen (z.B. Datenflussdiagramm) informatische Umsetzungsmöglichkeiten diskutieren.

Applying, justifying, assessing Anwenden, begründen, bewerten

The students ...

choose a specific (...) spreadsheet (...) application, implement their own drafted implementation possibilities in an optimal way and assess their outcome in the end. (...) Their justify their decisions and assess their outcome by applying sensible criteria.

wählen Programme zur (...) Tabellenkalkulation, (...) etc. gezielt aus, setzen ihre selbst entworfenen Lösungsvorschläge optimal um und bewerten abschließend ihre Ergebnisse. (...) Sie begründen ihre Entscheidungen und bewerten ihre Ergebnisse anhand sinnvoller Kriterien.

ICT 2.2.1 Spreadsheet Calculation I

working with spreadsheets (formulas, functions, copying formulas: relative and absolute cell references, data series, conditional statements, generating and interpreting charts)

The students

- develop approaches for complex tasks by means of models and implement them with a spreadsheet application.
- use spreadsheets, diagrams, sorting functions, and formatting options in order to represent numeric information by means of a spreadsheet application in a structured manner.

- entwickeln Lösungswege für komplexe Aufgabenstellungen mithilfe von Modellen und setzen sie in einem Tabellenkalkulationsprogramm um.
- setzen Tabellen, Diagramme, Sortierfunktionen und Formatierungsmöglichkeiten ein, um numerische Informationen mithilfe eines Tabellenkalkulationsprogramms strukturiert darzustellen.

Hinweise zum Unterricht

Die Aufgabe eignet sich am Anfang des Moduls 2.2.1. Es werden Inhalte aus 1.6 vorausgesetzt:

- Modelle zur Analyse und Lösung von Aufgaben, z. B. Datenflussdiagramm
- Datentypen, z. B. Text, Zahl, Datum
- Formeln und ihre Bestandteile
- einfache Funktionen und ihr Aufbau, z. B. zur Berechnung von Maximum, Summe, Mittelwert

Für den Einsatz im Bilingualen Zug wurde die Stunde in der Form angepasst, dass sowohl die englischen Fachtermini, Befehle etc., als auch die deutschen Fachtermini, Befehle etc. angegeben werden.

Die Anwendung *Orinoco* zur Erstellung von Datenflussdiagrammen steht bisher nur in deutscher Sprache zur Verfügung. Bei der Verwendung eines entsprechenden englischsprachigen Programms müssen die Anweisungen für *Orinoco* entsprechend angepasst werden.

Scaffolding

Als Rahmenhandlung dient der Schulausflug zum „Computer and Communications Museum of Ireland“, im Rahmen dessen verschiedene Workshops belegt werden können, wobei ein Workshop allerdings erst ab 15 Jahren ist. Die Klassenleitung bittet die IT Lehrkraft um Hilfe, eine auf den Namen und Geburtsdatum basierende Klassenliste mit Berechnung des Alters zu erstellen.

Folgende Schlüsselbegriffe sollten auf Flashcards während des Scaffolding verwendet und an die Tafel etc. geheftet werden (bleiben auch während des Arbeitens an den Arbeitsblättern / am PC sichtbar):

- date of birth (e.g. “When is your birthday? Which year? So your **date of birth** is the ...”)
- age (e.g. „How old is Jane Doe? So her **age** is ...)
- division, (“Hint: 12 **divided by** 3 is 4.”)
- leap year (e.g. “Some years have a special day, Feb 29th”)
- conversion / to convert

Folgende Grundlagen können gegebenenfalls mit in das Scaffolding als Wiederholung einfließen, benötigen aber keine Flashcards:

- Grundrechenarten (besonders: to multiply)
- command
- data flow diagram
- to stand out (e.g. „What is special about ...?”)
- ...

Hilfestellung – Guide Cards

Bei Schwierigkeiten können den Schülerinnen und Schülern die gestuften Hilfestellungen angeboten werden, z. B. in Form von Karten, die im IT-Raum ausliegen oder an die Tafel geklebt werden. Sinnvoll ist, dass die Lehrkraft diese erst auf Nachfrage den Schülerinnen und Schülern aushändigt, um vorschnellem Nachlesen der Hilfen entgegenzuwirken. Für die Berechnung des Alters können die Daten der eigenen Klasse genommen werden, falls die Schülerinnen und Schüler freiwillig ihr Geburtsdatum, z. B. vorne am Lehrerpult, eintragen.

Data Flow Diagram – Drawn by hand

Es ist für die Lösung der Aufgabe ausreichend, das Datenflussdiagramm per Hand zu zeichnen. Dabei müssen die Namen der verwendeten Funktionen nicht exakt der Schreibweise im Tabellenkalkulationsprogramm entsprechen. Zusätzlich sollte das Datenflussdiagramm mit Zahlen beispielhaft durchgerechnet werden (= Schreibtischtest). Dies fördert das Verständnis der nötigen Rechenschritte und hilft bei der Umsetzung des Lösungsentwurfs in eine Formel.

Data Flow Diagram – Orinoco or similar application

Das Zeichnen des Datenflussdiagramms mit dem Programm Orinoco wäre auch ausgehend von dem Datenflussdiagramm per Hand gemeinsam mit den Schülerinnen und Schülern denkbar. Eine Besonderheit von Orinoco ist, dass das Geburtsdatum in drei Teilen (Tag, Monat und Jahr) eingegeben und mit der Funktion DATUM in einen Zahlenwert umgewandelt werden muss. Im Tabellenkalkulationsprogramm wird die Umwandlung eines Datums in einen Zahlenwert automatisch vollzogen (vgl. Screenshot zur Hilfestellung für Aufgabe 1). Der Vorteil der Arbeit mit Orinoco ist, dass das Datenflussdiagramm sofort mit konkreten Eingabewerten auf Richtigkeit getestet werden kann. Weitere Hinweise zur Funktionalen Modellierung und zur Handhabung des Programms Orinoco sind in den ergänzenden Informationen zum Modul 1.6 „Funktionale Modellierung/Orinoco“ zusammengefasst.

Mit Orinoco kann die zum Datenflussdiagramm gehörige Termnotation angezeigt werden. Die Schreibweise des Terms entspricht der einzugebenden Formel. In der Formel müssen jedoch statt der Eingabewerte die entsprechenden Zelladressen des Tabellenblatts eingetragen werden (vgl. Lösungen zu den Aufgaben 2 und 3).

Age Calculation – difficulties

Abschließend erkennen die Schülerinnen und Schüler beim Test der Formel für die Berechnung des Alters, dass zwar die genaue Anzahl der Tage seit der Geburt berechnet werden, aber pauschal durch 365 geteilt wird. Die Nichtbeachtung von Schaltjahren mit 366 Tagen führt teilweise zu falschen Ergebnissen.

Additional Tasks

Bei Bedarf können die Zusatzaufgaben bearbeitet werden. In der Zusatzaufgabe 2 werden die Funktionen BRTEILJAHRE bzw. DATEDIF vorgestellt, die Schaltjahre berücksichtigen bzw. pauschal mit 30 Tagen im Monat und 360 Tagen im Jahr rechnen und so Lösungen zum Problem in Aufgabe 4 anbieten.

Aufgabe

Your homeroom teacher would like to have a student list, which not only contains the **names** of the students, but also their **age**.

The ICT teacher suggests that your class creates a spreadsheet with a spreadsheet application, which calculates the age by using the date of birth.

What your solution should contain (Requirements for your solution):

Work effectively and create, as far as possible, the formulas so you can use them to copy and paste.

1. Calculate the age of all of your fellow students by using their date of birth and today's date, without using the two commands mentioned in Additional Task 2, YEARFRAC (BRTEILJAHRE) or DATEDIF (DATEDIF).
2. Create a data flow diagram for this age calculation either by drawing per hand or using an application like Orinoco or else.
3. Prepare a spreadsheet, which is clearly laid out, which shows:
 - name
 - date of birth and
 - the age of each of your classmates.
4. Test your spreadsheet:
Add a students named Jane Doe and select her date of birth so that her 15th birthday would be:
 - yesterday
 - today or
 - in two days.

What stands out when the age is calculated? How are these solutions possible?

Additional Task 1

Set the format of all cells in the list, which contain an age information.

In order to do this, set a **custom** (*benutzerdefiniertes*) format so that all the numbers in the cells have the label "years" following them.

Example

Here you see an example for a custom format. The format was set to "meters". The data in the cells is displayed e.g. "3 meters", but internal only the number 3 is stored.

foreground		background (formular view)	
	Distance		Distance
	3 meters		3
	4 meters		4
	5 meters		5
	6 meters		6

Additional Task 2

Use these two new functions to calculate the age by using the date of birth in different ways. Use your findings from task 4 and test your formulas again.

syntax	DATEDIF(starting date;end date;unit)
usage	Calculates the number of days, months, or years between two dates With the third argument, the unit (e.g. „Y“) you say, if you want the solution in <u>whole</u> days (D), months (M) or years (Y). We would want to use years (Y).

syntax	YEARFRAC(starting date;end date;basis)												
usage	<p>YEARFRAC calculates the fraction (Bruchteil) of the year (e.g. 15,8 years) represented by the number of whole days between two dates (the start_date and the end_date).</p> <p>The basis sets how many days the years / months should have when calculating and if there is a leap year (Schaltjahr). If you do not put in a basis, the basis „0“ is used.</p> <table> <tr> <th>Basis</th><th>Berechnung</th></tr> <tr> <td>0</td><td>12 months 30 days per month (US-method)</td></tr> <tr> <td>1</td><td>exact amount of days per month, exact amount of days per year</td></tr> <tr> <td>2</td><td>exact amount of days per month, each year has 360 days</td></tr> <tr> <td>3</td><td>exact amount of days per month, each year has 365 days</td></tr> <tr> <td>4</td><td>12 months, 30 days per month (European-method)</td></tr> </table>	Basis	Berechnung	0	12 months 30 days per month (US-method)	1	exact amount of days per month, exact amount of days per year	2	exact amount of days per month, each year has 360 days	3	exact amount of days per month, each year has 365 days	4	12 months, 30 days per month (European-method)
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Detailed Guide for Task1

– How to calculate the age by using the date of birth

The age is calculated by the difference (“-“) between today’s date and the date of birth.

Then you get the number of days that the student lived up to today. This number has to be converted into years. („How many days are in a year?“ / “Days divided by 365 equals years.”)

The result is a decimal number. Now this number needs to be rounded.

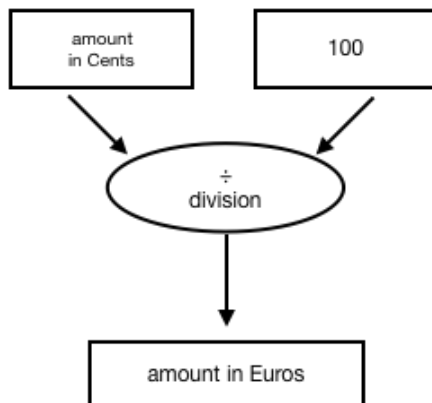
Then you have the amount of years the student has lived so far.

Guide (low assistance) for Task 2.

– How to draw the data flow diagram per hand

Example:

Converting an amount of money in cents into an amount of money in Euros.



Guide (low assistance) for Task 2.

– How to draw the data flow diagram using the application *Orinoco*

Orinoco provides the main basic functions of a spreadsheet calculation program.

To show input of the **date of birth** and the **conversion** into a number in *Orinoco*, you need to use the function DATE (DATUM).

Hint

Spreadsheet programs **automatically** convert dates into numbers.

Detailed Guide for Task 2.

– How to draw the data flow diagram using the application *Orinoco*

To calculate the **age** these functions are useful:

- ROUND(value, amount_of_decimals)
ABRUNDEN(Wert;Anzahl_der_Nachkommastellen)
→ rounds the value to the number of decimals
- INT(value)
GANZZAHL(Wert)
→ converts the value into the next smaller number
- TODAY()
HEUTE()
→ gives today's date as a number

Detailed Guide for Task 2.

– How to calculate the input values in the data flow diagram and show the data flow using the application *Orinoco*

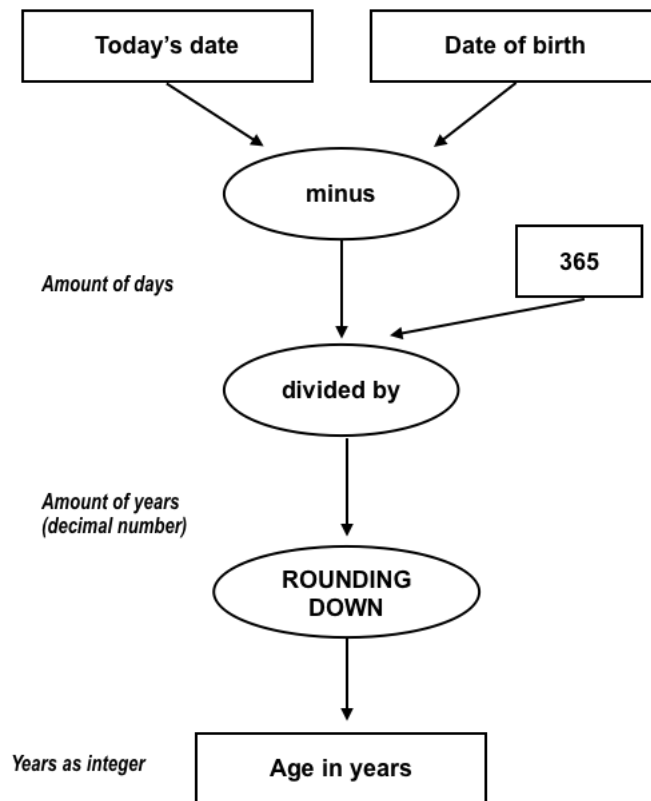
- Click on the 'Gears-icon' (',Zahnrad-Button') in the top right corner.
- A window titled 'Calculate function' (',Funktion berechnen') opens.
- Insert the input values as individual numbers,
e.g. year of birth: 2003; month of birth: 9; day of birth: 22 for a date of birth on September 9th, 2003 (2003-09-22).
- In addition, click on the data flow (',Datenflüsse')', under 'visualisation' (',Visualisierung') within the 'output' (',Ausgaben') selection.
→ By doing this all input values, intermediate values (dt. *Zwischenergebnisse*) and the output values are also shown as **number cards** within the data flow diagram.



Beispiele für mögliche Lösungen

Lösungsvorschläge Task 2

Datenflussdiagramm per Hand



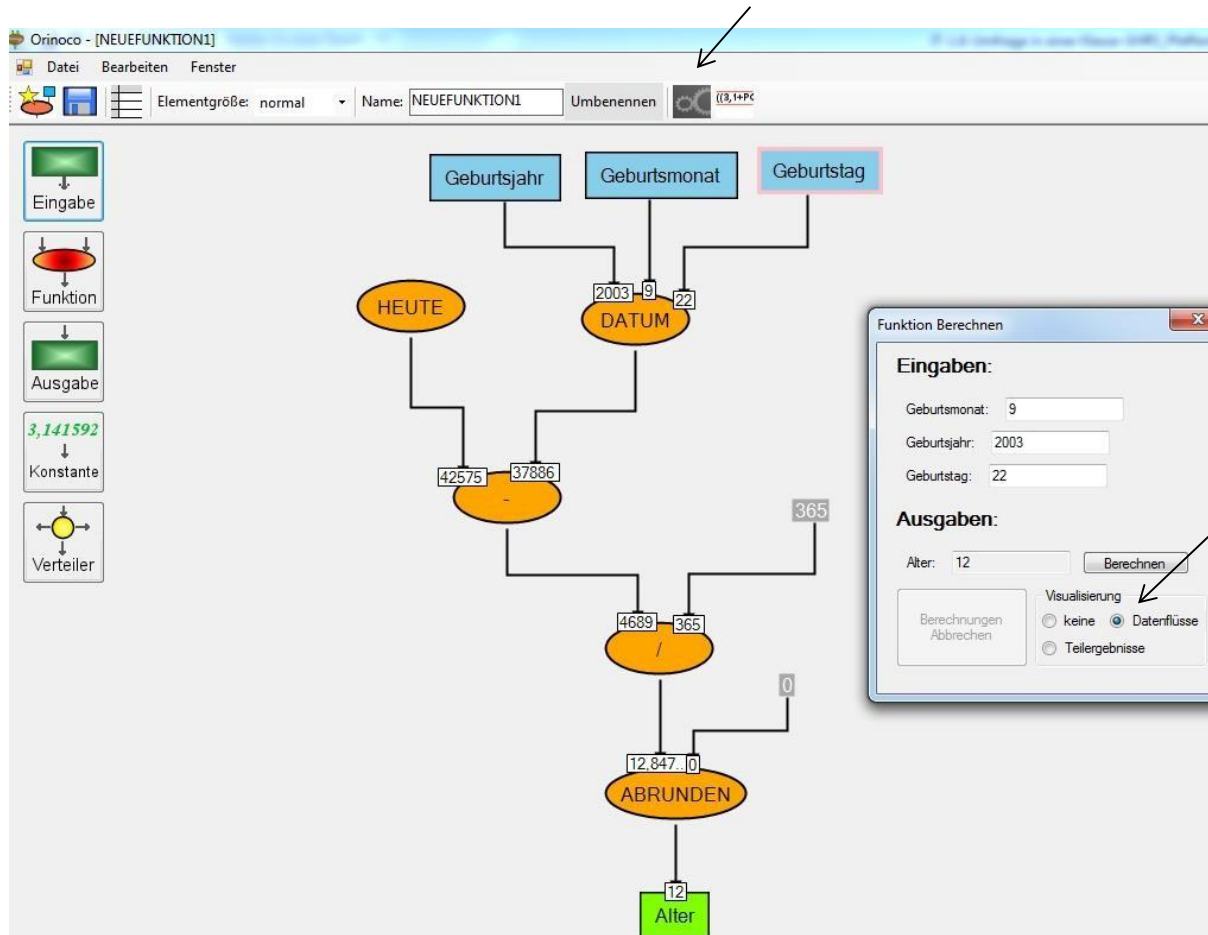
Term notation (as read from data flow diagram)

`Age_in_years(today, date_of_birth) = ROUNDING_DOWN((today - date_of_birth) ÷ 365)`

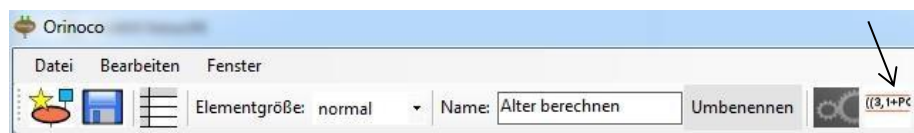
Data flow diagram created by the Orinoco application

Screenshot: Calculation with input data and displaying of data flow

[Eingabe Geburtsdatum 22.09.2003 (= 37 886); heutiges Datum: 24.07.2016 (= 42 575)]



Term notation (as shown in Orinoco)



AGE = ROUNDING_DOWN((TODAY() - DATE(year_of_birth ; month_of_birth ; day_of_birth)) / 365 ; 0)

Solution Task 3: Implementing in a spreadsheet application

The term notation is converted into a formula, in which the input values are replaced by the cell addresses of the spreadsheet and the syntax of the functions used is taken into consideration:

	A	B	C	D	E
1			Age Calculation Year 9		
2					
3		No.	Name	Age	D.o.B.
4		1	Adam Applegate	15	01.03.05
5		2	Bernie Brown	15	12.04.05
6		3	Charlie Chesterton	16	20.05.04
7		4	Jane Doe	15	03.06.05
8		5	Emma Easton	13	11.07.06
9		6	Fred Flintstone	15	24.12.04
10		7	George Garrison	15	06.01.05
11		8	Harold Hammond	15	14.07.04
12		9	Ike Inverness	14	13.08.05
13		10	John Jamison	16	01.05.04
14		11	Kylie Kenniman	14	31.10.05
15		12	Leeanne Lebowski	14	29.09.05
16		13	Margareth McDonoughue	15	07.10.04
17		14	Nellie Nelson	15	05.01.05
18		15	Oprah Olson	14	18.12.05
19		16	Paddy Pengram	14	25.11.05
20		17	Quentin Quilleran	14	07.07.05
21		18	Ronald Regent	15	13.07.04
22		19	Sally Stevens	14	03.09.05
23		20	Tonya Turner	16	09.04.04
24					

	A	B	C	D	E
1			Age Calculation Year 9		
2					
3		No.	Name	Age	D.o.B.
4		1	Adam Applegate	=ROUNDDOWN((TODAY()-E4)/365;0)	38412
5		2	Bernie Brown	=ROUNDDOWN((TODAY()-E5)/365;0)	38454
6		3	Charlie Chesterton	=ROUNDDOWN((TODAY()-E6)/365;0)	38127
7		4	Jane Doe	=DATEDIF(E7;TODAY();"Y")	38506
8		5	Emma Easton	=ROUNDDOWN((TODAY()-E8)/365;0)	38909
9		6	Fred Flintstone	=ROUNDDOWN((TODAY()-E9)/365;0)	38345
10		7	George Garrison	=ROUNDDOWN((TODAY()-E10)/365;0)	38358
11		8	Harold Hammond	=ROUNDDOWN((TODAY()-E11)/365;0)	38182
12		9	Ike Inverness	=ROUNDDOWN((TODAY()-E12)/365;0)	38577
13		10	John Jamison	=ROUNDDOWN((TODAY()-E13)/365;0)	38108
14		11	Kylie Kenniman	=ROUNDDOWN((TODAY()-E14)/365;0)	38656
15		12	Leeanne Lebowski	=ROUNDDOWN((TODAY()-E15)/365;0)	38624
16		13	Margareth McDonoughue	=ROUNDDOWN((TODAY()-E16)/365;0)	38267
17		14	Nellie Nelson	=ROUNDDOWN((TODAY()-E17)/365;0)	38357
18		15	Oprah Olson	=ROUNDDOWN((TODAY()-E18)/365;0)	38704
19		16	Paddy Pengram	=ROUNDDOWN((TODAY()-E19)/365;0)	38681
20		17	Quentin Quilleran	=ROUNDDOWN((TODAY()-E20)/365;0)	38540
21		18	Ronald Regent	=ROUNDDOWN((TODAY()-E21)/365;0)	38181
22		19	Sally Stevens	=ROUNDDOWN((TODAY()-E22)/365;0)	38598
23		20	Tonya Turner	=ROUNDDOWN((TODAY()-E23)/365;0)	38086
24					

Anregung zum weiteren Lernen

Die Aufgabe könnte z. B. im Weiteren als Grundlage für eine Wiederholung der Sortiermöglichkeiten eines Tabellenkalkulationsprogrammes dienen oder auch für eine Wiederholung der „Bedingten Formatierung“.

Quellen- und Literaturangaben

- LIS-Aufgabe (regulär)
- Computer and Communications Museum of Ireland (<https://ccmireland.com/>)
Thank you
- Orinoco – Programm zur Erstellung von Datenflussdiagrammen:
<http://klassenkarte.de> (Stand: 12/2016)
- Bildquellen: Datenflussdiagramme und Screenshots des Tabellenblatts (Autorin C. Hirtl-Baur)
- Schnelle-Online.info: Die Excel-Funktion BRTEILJAHRE,
<http://www.schnelleonline.info/Excel/BRTEILJAHRE-Datum-Differenz.html>
(Stand: 12/2016)
- Schnelle-Online.info: Die Excel-Funktion DATEDIF,
<http://www.schnelleonline.info/Excel/DATEDIF-Datum-Differenz.html> (Stand: 12/2016)

WS 1

A VISIT TO THE



Computer & Communications
Museum of Ireland Limited

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Thank you for letting us use your logo and name!

"The Computer and Communications Museum of Ireland explores technology by preserving the past, demonstrating the present and educating for the future."

<https://ccmireland.com/home/>

Spreadsheet Age Calculation

Planning a school trip to the CCMI in Galway

Your homeroom teacher is planning to take her ICT class on a field trip to the CCMI, the Computer and Communications Museum of Ireland in Galway. The museum shows the history of computer technology in Ireland and more. The class will be given a guided tour of the museum and, as a special highlight, the class is divided into groups to explore the computers, machines and programs in workshops.

There are three workshops:

- Introduction to Morse (ages 7-17)
- Introduction to the Basic programming language (ages 10-17)
- 3D Printing using recycled plastic (ages 10-17)

WS 2



Many of the students are between 13 and 15 years old. But to take part in the **Morse** workshop you need to be at least 15 years old.

Your homeroom teachers has a list of the names of the group and the dates of birth.

Help your group and make a list of all the students and how old they are going to be on the day of the trip to the museum in Galway.

Here is the task list.

TASK: Student list with age

Your homeroom teacher would like to have a **student list**, which not only contains the **names** of the students, but also their **age**.

The ICT teacher suggests that your class creates a spreadsheet with a spreadsheet application, which calculates the age by using the date of birth.

Requirements for your solution - What your solution should contain:

Work effectively and create, as far as possible, the formulas so you can use them to copy and paste.

1. **Calculate** the **age** of all of your fellow students by using their date of birth and today's date, **without** using the two commands mentioned in Additional Task 2 , YEARFRAC (BRTEILJAHRE) or DATEDIF (DATEDIF).
2. Create a **data flow diagram** for this age calculation either by drawing per hand or using an application like Orinoco or else.
3. **Prepare a spreadsheet**, which is clearly laid out, which shows
 - name
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4. **Test your spreadsheet:**

Add a students named Jane Doe and select her date of birth so that her 15th birthday would be

 - yesterday
 - today or
 - in two days.

What stands out when the age is calculated? How are these solutions possible?



ADDITIONAL TASKS:

Additional Task 1

- ◆ Set the format of all cells in the list, which contain an age information.
- ◆ In order to do this, set a custom (benutzerdefiniertes) format so that all the numbers in the cells have the label "years" following them.

Example:

Here you see an example for a custom format. The format was set to "meters". The data in the cells is displayed e.g. "3 meters", but internal only the number 3 is stored.

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Additional Task 2

- ◆ Use these two new functions to calculate the age by using the date of birth in different ways. Use your findings from task 4 and test your formulas again.

syntax	DATEDIF(starting date;end date;unit)
usage	Calculates the number of days, months, or years between two dates With the third argument, the unit (e.g. „Y“) you say, if you want the solution in <u>whole</u> days (D), months (M) or years (Y). We would want to use years (Y).

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Guide Cards - Copy, cut, and maybe laminate these cards. Put them on an extra table face down.

Detailed Guide for Task1
– How to calculate the age by using the date of birth

The age is calculated by the difference (“-“) between today’s date and the date of birth.

Then you get the number of days that the student lived up to today. This number has to be converted into years. („How many days are in a year?“ / “Days **divided by** 365 equals years.”)

The result is a decimal number. Now this number needs to be rounded.

Then you have the amount of years the student has lived so far.

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Then you get the number of days that the student lived up to today. This number has to be converted into years. („How many days are in a year?“ / “Days **divided by** 365 equals years.”)

The result is a decimal number. Now this number needs to be rounded.

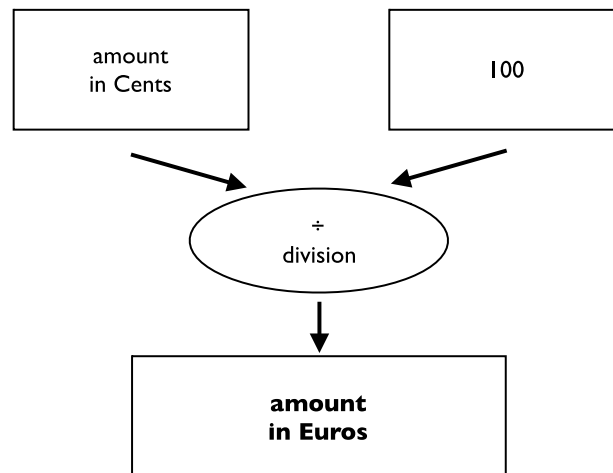
Then you have the amount of years the student has lived so far.

Guide Cards - Copy, cut, and maybe laminate these cards. Put them on an extra table face down.

Guide (low assistance) for Task 2.
– How to draw the data flow diagram per hand

Example:

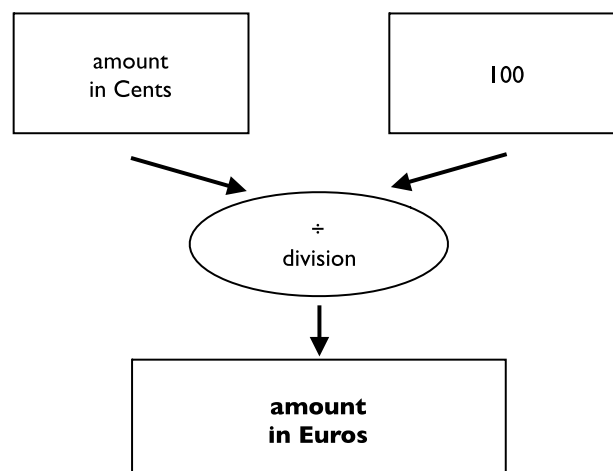
Converting an amount of money in cents into an amount of money in Euros.



Guide (low assistance) for Task 2.
– How to draw the data flow diagram per hand

Example:

Converting an amount of money in cents into an amount of money in Euros.



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Guide (low assistance) for Task 2.
– How to construct the data flow diagram with Orinoco

Orinoco provides the main basic functions of a spreadsheet calculation program.

To show input of the date of birth and the conversion into a number in Orinoco, you need to use the function DATE (DATUM).

Hint

Spreadsheet programs automatically convert dates into numbers.

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Detailed Guide for Task 2.

– How to draw the data flow diagram using the application *Orinoco*

To calculate the **age** these functions are useful:

- ROUND(value, amount_of_decimals)
ABRUNDEN(Wert;Anzahl_der_Nachkommastellen)
rounds the value to the number of decimals
- INT(value)
GANZZAHL(Wert)
converts the value into the next smaller number
- TODAY()
HEUTE()
gives today's date as a number

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Detailed Guide for Task 2.

– How to calculate the input values in the data flow diagram and show the data flow using the application *Orinoco*

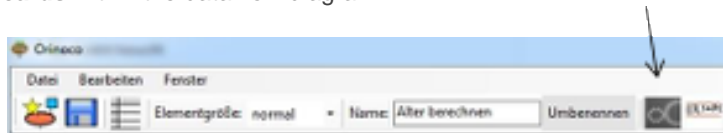
Click on the 'Gears-icon' (Zahnrad-Button) in the top right corner.

A window titled 'Calculate function' (Funktion berechnen) opens.

Insert the input values as individual numbers, e.g. year of birth: 2003; month of birth: 9; day of birth: 22 for a date of birth on September 9th, 2003 (2003-09-22).

In addition, click on the data flow ('Datenflüsse'), under 'visualisation' (Visualisierung) within the 'output' (Ausgaben) selection.

By doing this all input values, intermediate values (dt. *Zwischenergebnisse*) and the output values are also shown as **number cards** within the data flow diagram.



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