Zig Zag Education

Digital

T Level | Pearson | 603/5832/4

Employer Set Project

Scaffolded Practice Activities

for T Level in Digital Production, Design and Development

Download support files from zzed.uk/productsupport

zigzageducation.co.uk

POD 12622

Contents

Teacher's Introduction

How to use this resource

This resource contains a series of activities to help students learn and practise the skills they will need to perform well in the Employer Set Project (ESP). To provide scaffolded learning the activities are, therefore, smaller than the actual ESP tasks and provide more guidance.

We recommend that after your students complete each task, you discuss with them how to get maximum marks.

Although the mark allocations and mark schemes are similar in concept to the actual ESP, they have been adapted for the purpose of these activities.

Overview of the ESP requirements

The ESP is a holistic project, and students are expected to draw on knowledge and understanding from the core content in a synoptic manner to respond to a brief within a vocational context effectively.

The ESP is marked out of 100 and covers a third of the Core Component, half of the total Guided Learning Hours.

Students undertake a project in response to a realistic contextual challenge set by the exam board. Before the main project tasks begin, students are issued a pre-release task. Subsequently, students do five supervised assessments totalling 14.5 hours in May/June or November, which are externally marked.

Students build up a portfolio of evidence from each task, containing planning documentation, an annotated digital portfolio, a prototype digital product, testing evidence and evaluation.

For the ESP, in addition to using Python 3 and its standard libraries, students are expected to have a working knowledge for the additional libraries *pandas* and *Matplotlib* (*Tkinter*, *wxPython*, *NumPy* and *TensorFlow* were removed from the specification for teaching from September 2023 onwards).

Software

Whichever software you use, students are only allowed to use offline software for their ESP tasks.

- Excel can be used for Gantt charts, but it is a bit fiddly, especially when making changes, and doesn't give alternative outputs or reports.
- A lot of schools and colleges use *ProjectLibre,* which is a free Open Source program for project management – see **https://www.projectlibre.com/**
- *Microsoft Project* is part of the Office Apps. However, it isn't included in all Office packages as an installed program.

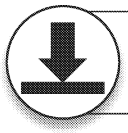
More T Level resources from ZigZag Education

Go to **https://ZigZagEducation.co.uk** → **Computer Science and IT** → **T Levels** to see all available resources, including:

- Learner Companions for content areas 1–8
- Topic Tests for content areas 1–8
- Online practice (eRevision) for Level 2 English

Also see **https://ZigZagEducation.co.uk** → **Computer Science and IT** → **Programming** for Python resources.

May 2024



Student files and solutions are provided on the ZigZag Education Support Files system, which can be accessed via **zzed.uk/productsupport**

Brief and Pre-task – Information for Students

Before your supervised tasks start, you will be given a pre-task. You will be given
time to get familiar with it, and you are allowed to spend more than six hours on
of class time.

Your objective is to become familiar with the ways in which digital tools and tech
sector identified in the task. Examples of sectors include the finance sector, the
sector. The pre-task will give you some hints on sub-areas to look at. For example
mentioned:

- data analysis and modelling
- data and information security
- stock control and POS
- online retail
- customer loyalty schemes
- technical support solutions

During this time you can use the Internet, work with others, share findings from y
notes; however, you will not be allowed to take your notes into the supervised as

The pre-task is very much background information. This is important to do becau
to understand the context of what all the tasks are asking, which is particularly im
will be under time pressure and (b) you will not have access to the Internet for th

After the pre-task you will do five supervised assessments totalling 14.5 hours in
are externally marked:

- Task 1: Planning a project
- Task 2: Identifying and fixing defects in an existing code
- Task 3: Designing a solution
- Task 4a: Developing a solution
- Task 4b: Reflection and evaluation

Task 1: Planning a Projec

Assess the strength and skills of people and assign appropriate task

In your assessment, you are likely to be given information about the people who
project; for example, in June 2022, students were given a list of five people in a p
This information might be clearly presented, or you m to pick it out from

Sometimes it will be obvious who to a a role; for example, there might
obviously be the project mana . Ot her times it might be that different peop
cost or time constrai given narrow down the choice. Or you might be
justify your

Activity 1.1

Read carefully through the list of people below and highlight the following:

- Their name
- How much they are paid (you will need this for cost plans)
- Skills and programming languages (you will need this to match them to tasks
- Any other key information, including any limitations

Anurag Acharya	Ruchi Sanghvi	Galla Kumari	Amit Si
Senior Software Engineer	Junior Software Engineer	Hardware and Networking Tech	Database
Extensive experience in managing projects and dealing with stakeholders and suppliers Extensive e ence in software deployment Has some background in hardware and networking set-up Experienced in many languages but hasn't coded for many years	Strong coding skills in Python and C L terface experience including CSS and JavaScript Very personable	Se ecialist Very knowledgeable and keen on trying new technologies but liable to make mistakes Not great with customers	SQL specialis Excellent at to a brief Experienced all-round sk although is a slow coder Has certifica software te Very shy and introverted
£100 per hour	£30 per hour	£40 per h r	£40 pe

Using the best people for the job, without taking into account any time or cost li
you would allocate to each of the following tasks, and why? The coding is broke
It is estimated that there will be five major faults overall and 10 minor faults with

Task	Estimated Hours	Total Estimated Hours	Personnel	
Source supplier for cloud server	20			
Install and set up cloud server	30			
Testing of [illegible]are	25			
Module 1: Create database and database queries needed for system	200			
Module 2: Code data entry (with basic functional pages)	150			
Module 3: Code analysis and reports	150			
Module 4: Add design elements into user interface	80			
Create a test plan	30			
Unit testing	[illegible]dule			
Integratio[illegible]g	30			
Fixing and regression testing major faults	15 per fault			
Fixing and regression testing minor faults	5 per fault			
User/acceptance testing	15			
User training	15			
Customer support during changeover	30			
	Total Hours:			

Activity 1.2

There are a number of tasks that apply to multiple modules. Rearrange the tasks under each module rather than as separate tasks; for example, a test plan will ne four modules.

Why will this be useful for planning?

Prioritise tasks and make sc[illegible] decisions in response to a defi

You will need to work o[illegible] of the project, taking into consideration wha with other t[illegible]

There may be more than one solution; for example, you may have the choice of u experienced staff that take longer and require more oversight, or more expensive

If the work cannot be completed by the deadline then you will have to rearrange example, if one person is doing a lot of the work, then it may need to be shared s work on it at once.

You will be given a list of tasks that need to be done and how long they take.

- Start by putting this list into a spreadsheet and add a total for the number of
- Next to each task put the person that you would allocate to this job. You ma
  - You are likely to allocate the lowest skilled person that is able to do a ta cost limit.
  - Some tasks could have two people doing them at the same time.
  - Some tasks could be done in parallel, partic[illegible] if there is a time limit people can't do two different tasks at the same time.
- Check your total time, taking int[illegible]t jobs that are done in parallel or ca one person at the sam[illegible]

Activity 1.3

Assume that all staff work eight hours a day – and, therefore, 40 hours a week – a
or holidays during this period. Assume also that unit testing can begin as soon as
complete. How many days will the project take, and how much will the staffing c

However, the project needs to be completed two weeks earlier. Propose what ch
assigned to tasks in order to achieve this. Give your rationale.

The project manager has been called to a meeting to discuss the cost of the proje
staff budget will be reduced. How could staffing costs be reduced without having
quality of the project?

Resource and cost plan

You are likely to be given a list of resources (in addition to staff resources) and co
materials, physical resources and personnel from the information provided, alloca
the costs.

Read carefully through the list of resources and do the following:

- Work out whether each resource is needed for the project.
- Work out the comparative costs, e.g. some costs may be by the hour and oth
  that they are all the same units.
- Some costs may need to be compared. For example, you may need to make
  installing your own server and paying for the software, compared to renting

In a spreadsheet, write out all the things that are needed for the project from the
resources, how many/much you need of each resource, and what the total is for t

Note that some costs (e.g. project leaders' pay) will vary depending on how long t

Activity 1.4

Here are some key facts and figures about the company the project is for:

- Annual income: £650,000
- Annual costs before this project: £560,000
- Additional sales per year anticipated as a result of this project: 5%

Here are the costs, in addition to staffing, for this project:

- Upgrading internal hardware: £20,000
- Training time for users on new system: £4,000
- Annual charge for cloud server and software: £2,000
- Annual charge for cloud development (GitHub): £500

(a) The company is assuming the new system will run and produce additional sa
profitable this project is on the basis of this. To do this you will need to work out t
subtract them from the additional sales. Show your working.

(b) The company providing the cloud server also offers optional ongoing technic
year, to install updates and fix any basic issues with settings. How might the
worth doing, and what considerations would they make? Give your rationale

(c) What costs might be significant that haven't been considered so far, includi

Gantt charts

A Gantt chart is a project management tool that lists all the tasks that need to be
(e.g. day 1, day 2, etc.), and shows a solid bar showing how long each task takes t

Key elements of a Gantt chart are:

1. Some tasks can be done in parallel with other tasks and so can be shown und
   illustrate this, assuming there are the resources and possible to do both tasks
2. Some tasks cannot be started until other tasks are completed, so the bar of t
   the first task is finished.

As a result, a Gantt chart can give an estimate or a minimum time of how long th
into account tasks that can be done in parallel.

Specialist so is available to create Gantt charts, but for the purposes of this

Here is a list of subtasks to make a cup of tea in seven minutes:

1. Get out a cup and put in a teabag (30 seconds)
2. Fill up the kettle and switch it on (1 minute)
3. Wait for the kettle to boil (3 minutes)
4. Pour water into the cup and leave to brew (1 minute)
5. Take out the teabag (30 seconds)
6. Get the milk out of the fridge and pour some into the cup (1 minute)

This Gantt chart shows that the tea can be made in six minutes. Notice that task
halves as the milk can be fetched from the fridge while the kettle is boiling.

Minutes	1		2		3		4		5	
Fill up the kettle and switch it on										
Wait for the kettle to boil										
Get out a cup and put in a teabag										
Get the milk out of the fridge										
Pour water into cup and leave to brew										
Take out the teabag										
Pour some milk into the cup										

Activity 1.5

In Activity 1.3 you proposed how the project could be completed two weeks earli
for the project based on your proposal. For simplicity, present your Gantt chart i
reality it would be in days.

Software Development Life Cycle

You may be asked a question that demonstrates your understanding of project m
For example, you may be asked if there are any parts of the software developme
covered in the project. In particular you should understand the waterfall framew

Waterfall project management methodology

This is a linear approach with the following key characteri

1. Requirements gathering – this is likely to be g ef by the customer, but
some research.
2. System design – technical sp s, diagrams and breakdown of object
3. Implementation – th g
4. Testing i creating a test plan (including any data prepared) then
each a he system, and feeding back changes that need to be made to
integrat testing is carried out when the system is completed.
5. Deployment – this is setting up the hardware and pushing the code from tes
Following this, more testing will be done on the live release.
6. Maintenance and support – fixing bugs, responding to user feedback, updat
hardware and software updates.

Agile project management methodology

This is the concept of using a more iterative and flexible approach to project man
following ideas may be applied to the management of the project:

- Programmers meet periodically (normally between one and four weeks) to
including planning, coding, testing and review.
- Teams self-organise within the team and a high level of communication and
within the team. Ideally a team is made up of members with diverse skills.
- Continuous feedback between coding teams, manag s nd stakeholders is
quickly and early adaption to resulting chang s e d.
- Continuous reflection after each sp m improvement is encouraged in a
processes, quality of codi nd c mmunication, and develop skills.
- Incremental devel t th an aim to deliver a working product and then
than d a e solution which is not looked at by stakeholders until t

Frameworks h their own terminology and variations of agile methodology hav
Scrum, Kanban and XP (Extreme Programming). Issue boards and other software
agile methodologies.

Project management software

A spreadsheet can be used to easily create a Gantt chart. However, specialist so
makes it easier to enter tasks without having to insert and delete roles, and also
including personal versions for each person doing a task and automatically addin

Activity 1.6

What are the stages of the software development life cycle model?

List the tasks in Activity 1.1 and indicate which stag s sc tware developme
comes under.

For this project, briefly outline at h pens in the stages of the software develo
model not covered by t k n Activity 1.1.

Important

It is very important that you give the rationale (explanation) for your decisions in every tas
half of the marks in your live assignment will be awarded for logically and correctly comple
approximately half the marks are awarded for your explanations, through which you demo
thorough and perceptive considerations of all the factors (e.g. cost, risk, benefit, timing, pr

Task 2: Identifying and Fixing Defects i

You will be provided with a set of requirements. This might be some combinatio
or a written description. You will need to understand every point in these requir

Test plan

The test plan is the opportunity to create one or more tests to address every poi
some examples.

Example A

'Program allows a user to enter their name and a positive number
circle, and to output their name and the circumference and area
Create a test plan for this program.'

This description doesn't list any limitations on what can be entered, but we know
be a positive number and that if the number is too big the program might crash, s
into a test plan.

Also, the brief contains a formula, so there is quite likely to be a deliberate mista
discover through testing.

Here is a suggested test plan for the above example.

Description of Test	Test Data	Expected Outcome
Check program runs		Program should start without erro
Normal name	Hamed Mahmoud	Name should be accepted and out on screen
Name con apostroph	Mary O'Donnell	Name should be accepted and out on screen
Very long name	Amarion Aman Jafeerah Minhas Abd-El-Kader Yacoub Rayhan Abbasi	Name should be accepted and out on screen
Name not entered	[Empty string]	Program should ask for name aga
Negative radius	-4	This should not be accepted
Radius of 0	0	Either this should not be accepted it should give circumference of 0 ar area of 0
Normal radius (decimal)	17.9	To 2dp, circumference should be 112.47 and area should be 106.60
Very large	9999999999	To 2dp, circumference should be 6.28×10^{10} and area should be 3.14×19^{20}

You will need to assess all the requirements for yourself as appropriate for the p
main types of tests you may need to do:

1. Check that the program runs – this just means that there aren't any syntax e
   before it starts, not logic errors.
2. Check any input:
   a. Normal data should work
   b. Unusual but valid data should work (e.g. ap s in names)
   c. Different but valid formats should w rk (e. ecimals for numbers, unl
      the format is stated)
   d. Valid extreme data s ld w rk (e.g. very large but acceptable values)
   e. Erroneous d ta s ula give a warning but not crash the program (e.g. n
      sl e p sitive, letters where it should be a number)
   f. If t ould enter an option (e.g. menu A, B or C) ensure that all optio
      that erroneous options (e.g. D) do not crash the program
3. If there are formulas, check that they give the correct output:
   a. For at least two sets of input
   b. That they work for very large and very small values
   c. That input is not allowed for values that are invalid (e.g. for a ÷ b, b ca
4. If there are loops:
   a. Check that the condition is correct, e.g. that it runs from 0 or from 1, a
      correct, e.g. whether it should be to <10 or <=10
   b. That any output happens the last time around the loop (e.g. if a subtot
      changes, the code to print the subtotal may need to be run an extra ti
5. If there are function calls:
   a. Check that the correct parameters are used when c lling the function
   b. Check that the function does what it should f r a ceptable input
6. Check that output:
   a. Is given in the correct fo m t p und sign and two decimal places fo
   b. Fits on the scree for v id large output (e.g. very long name or very lar

Your turn

Here is a sol tion to the above example in Python. Use the test plan above to te
the errors your tests identify, and then retest repeatedly until everything works.

```
import math

define calculate_circle_properties(name, radius):

    circumference = 2 * math.pi * radius
    area = radius * math.pi**2

    print("Name:", name)
    print("Circumference:", circumference)
    print("Area:", area)

name = input("Enter your name: ")
radius = float(input("Ent r t  ds of the circle: "))

calculate_ roperties(name, radius)
```

Below is what your test plan might look like – compare it to your version:

Description of Test	Test Data	Expected Outcome	O
Check program runs		Program should start without error	Synta line 3
Normal name	Hamish McCloud	Name should be accepted and output on screen	✓
Name containing apostrophe	Mary O'Brien	Name should be accepted and output on screen	✓
Very long name	Amarion Aman Jafeerah Minhas Abd-El-Kader Yacoub Rayhan Abbasi	Name should be accepted and output on screen	✓
Name not entered	[Empty string]	Program should ask for name again	Didn't name blank printe
Radius of 0	0	Either this should not be accepted or it should give a circumference of 0 and an area of 0	✓ giv
Normal radius (decimal)	17.9	To 2dp, circumference should be 112.47, and the area should be 1006.60	Circu corre area
Negative radius	-4	This should not be accepted	It give circu and areas
Very large radius	9999999999	To 2dp, circumference should be 6.28×10^{10} and area should be 3.14×19^{20}	✓

Here is an example of a corrected solution with changes; compare this to your so

```
import math

def calculate_circle_properties(name, radius):
    circumference = 2 * math.pi * radius
    area = math.pi * radius**2

    print("Name:", name)
    print("Circumference ... ference)
    print("A... ar...

name = ""
while not name:
    name = input("Enter your name: ")

radius = None
while radius is None or radius <= 0:
    try:
        radius = float(input("Enter the radius of the circle (positive value): "))
        if radius <= 0:
            print("Invalid input. Please enter a positive value for the radius.")
    except ValueError:
        print("Invalid input. Please enter a valid number.")

calculate_circle_properties(name, radius)
```

Important

Some things to watch out for to be able to get full marks:

1. Ensure you describe each test you plan to do and **why** you intend to do it.
2. List the exact data you will use.
3. Describe the expected results, and then the actual results. If they are the same, s
   explain what has gone wrong.
4. Describe what you need to do to fix any errors.
5. When you fix the errors, ensure your updated code is using precise logic and pro
6. When you have fixed the errors, run the tests again to show that you have fixed t

Activity 2.1

Below is a program in Python that should ask for your date of birth and give you a
the day of the week you were born on, '2' for which star sign you are, '3' for how
'4' to ask you how tall you are and how many centimetres on average you have g
should continue giving you the options until you press 'X'.

Create a test plan based on the description above and in the file **task-2-1.py**), an
find in the program. Rerun your tests to check that all work now.

```
# Function to determine the day of the week for a given date
def get_day_of_week(date):
    days_of_week = ['Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Saturday', 'S
    return days_of_week[date.weekday()]

# Function to determine the star sign for a given date
def get_star_sign(date):
    if (date.month == 1 and date.day >= 20) or (date.month == 2 and date.day <=
        return "Aquarius"
    elif (date.month == 2 and date.day >= 19) or (date.month == 3 and date.day <
        return "Pisces"
    elif (date.month == 3 and date.day >= 21) or (date.month == 4 and date.day <
        return "Aries"
    elif (date.month == 4 and date.day >= 20) or (date.month == 5 and date.day <
        return "Taurus"
    elif (date.month == 5 and date.day >= 21) or (date.month == 6 and date.day <
        return "Gemini"
    elif (date.month == 6 and date.day >= 21) or (date.month == 7 and date.day <
        return "Cancer"
    elif (date.month == 7 and date.day >= 23) or (date.month == 8 and date.day <
        return "Leo"
    elif (date.month == 8 and date.day >= 23) or (date.month == 9 and date.day <
        return "Virgo"
    elif (date.month == 9 and date.day >= 23) or (date.month == 10 and date.day <
        return "Libra"
    elif (date.month == 10 and date.day >= 23) or (date.month == 11 and date.day
        return "Scorpio"
    elif (date.month == 11 and date.day >= 22) or (date.month == 12 and date.day
        return "Sagittarius"
    else:
        return "Capricorn"

# Function to calculate the number of days between two dates
def calculate_age_in_days(birth_date, current_date):
    age = current_date - birth_date
    return age.days

# Function to calculate the average growth in centimetres per year
def calculate_average_growth(height, age_in_years):
    if age_in_years > 0:
        average_growth = height / age_in_years
        return average_growth
    else:
        return 0
```

```
# Prompting the user for their date of birth
date_of_birth = input("Enter your date of birth (format: DD-MM-YYYY): ")
birth_date = datetime.datetime.strptime(date_of_birth, "%d-%m-%Y").date()

current_date = datetime.date.today()

# Calculating the age in days and years
age_in_days = calculate_age_in_days(birth_date, current_date)
age_in_years = age_in_days // 365

# Displaying the menu
print("Menu:")
print("1. Find out the day of the week you were born on")
print("2. Determine your star sign")
print("3. Calculate how many days old you are today")
print("4. Provide information about your height")
print("X. Exit the program")

# Getting the user's choice from the menu
choice = None
while choice != 'x':
    choice = input("Enter your choice (1-4, or X to exit): ")

    # Handling the user's choice
    if choice == '1':
        day_of_week = get_day_of_week(birth_date)
        print("You were born on a", day_of_week)
    elif choice == '2':
        star_sign = get_star_sign(birth_date)
        print("Your star sign is", star_sign)
    elif choice == '3':
        print("You are", age_in_days, "days old.")
    elif choice == '4':
        height = float(input("Enter your height in cm: "))
        average_growth = calculate_average_growth(height, age_in_years)
        print("On average, you have grown", average_growth, "cm per year.")
    elif choice == 'X':
        print("Exiting the program...")
    else:
        print("Invalid choice. Please enter a valid option (1-4, or X to exit).")
```

Task 3: Designing a Soluti

The data file provided contains data from Ofqual (published under the Open Gov
shows the number of male and female candidates that took A Level subjects betw
percentage that obtained each grade.

A school wants to analyse this data set so they ca[illegible]mpare it to school outcome
where boys are not performing as well a[illegible]nd other subjects where girls are
and they want to see how their [illegible]sul[illegible]mpare to the national results to decide

a) They wan[illegible]s[illegible]re[illegible]t which shows each subject and the average percen
years [illegible]a[illegible]d for girls.

b) They want to be able to select any subject and year and see a graph of the p
students, and a graph of each grade for female students.

They want a solution that is easy to use. The information must be displayed in a
clear labels and headings

Activity 3.1

Create a flow chart to communicate the algorithms needed for the solution to par
different possible solutions, but for the purpose of this task use one that cycles thr

The file called **ZZ ESP Task 3.csv** contains the data – you can use this to help you
extract from the file. Note that the brief above asks s[illegible]ly for the female a

Subject	Gender	Year	NumCandidates	A*	A	B
Art and design su[illegible]s	All	2010	42575	13.3	18.1	25.5
[illegible]	Female	2010	30935	13.7	19.4	26.3
[illegible]sign subjects	Male	2010	11645	12.1	14.7	23.5
[illegible]sign subjects	All	2011	42525	14.3	16.6	26.3
Art and design subjects	Female	2011	31220	15.1	17.5	27.4
Art and design subjects	Male	2011	11305	12.1	14	25.1
Art and design subjects	All	2012	43020	13.2	16.8	27.3
Art and design subjects	Female	2012	31945	13.6	17.8	29
Art and design subjects	Male	2012	11070	12	13.9	24.4
Art and design subjects	All	2013	40880	12.3	16.2	29.3
Art and design subjects	Female	2013	30795	12.6	17.4	30.4
Art and design subjects	Male	2013	10080	11.4	12.6	25.6
Art and design subjects	All	2014	41810	11.7	15.8	29.2
Art and design subjects	Female	2014	31525	12.1	17	30.2
Art and design subjects	Male	2014	10285	10.4	12.3	26.1
Art and design subjects	All	2015	41710	12	16.2	29.2
Art and design subjects	Female	2015	31775	12.4	17.5	30.3
Art and design subjects	Male	2015	9935	10.5	12.6	25.4
Art and design subjects	All	2016	40330	12.3	15.3	29.3
Art and design subjects	Female	2016	3[illegible]0	12.9	16.4	30.1
Art and design subjects	Male	2016	[illegible]0	10.5	11.7	26.6
Art and design subjects	All	20[illegible]7	40470	12.3	15.1	30.6
Art and design subjects	Femal[illegible]	[illegible]	30580	12.6	15.7	31.3
Art and design subjects	Male	2017	9890	11.1	13.2	28.3
Art and design subj[illegible]	All	2018	39850	12.3	15.3	31
Art and desi[illegible]	Female	2018	29930	13	16.2	31.9

Activity 3.2

Create pseudocode to communicate the algorithms needed for the solution to pa
The algorithm design should be clear enough to communicate the intended solut
programmer to work from to write the code.

Task 4a: Developing a Solu

For Task 4a you will be given some code and asked to make changes to it. So far t
solution to the task for which you had to use flow charts or pseudocode to desig

This means that you will need to look at and fully unders[illegible] the code provided,
changes to it as required. Note that the code will be using *pandas* for reading in t
Matplotlib if there are any graphs, so you should be familiar with both of these.

Activity

The solution for the school analysing A Level results has been coded (see file **task-4-1.py**) by a senior programmer. The code processes data from a csv file (see file **zz-esp-task-3.csv**).

```
Art a
Grade
-----
A*
A
B
C
D
E

Biol
Grade
-----
A*
A
```

The report shows the percentage of female and male students who achieved each grade for each subject. The total number of female and male students who took each subject is also read in from the file.

Before you do the activity below, you need to understand what this code does:

1. Open the .csv file and ensure you understand what information it contains.
2. Go through the code, line by line, looking up anything you don't understand. The programmer has added comments to the file, which will help you.
3. If there are any bits you don't understand, then you can print variables so you can see what is going on, and use any debugging tools in yo

Once you understand the code, update it to show:

1. The number of female and male students that achieved the grade – you can work this out using the total number of female or male students and the percentage that achieved that grade. Show the percentage figure in brackets.

2. The total number of female and male students who took each subject at the bottom of the data for each subject. One way of doing this is to keep a running total which adds the new figures each time it goes around the loop.

```
Art and de
Grade  Fem
----------
A*     59,
A      74,
B      120
C      90,
D      38,
E      11,
Total  397

Biology
Grade  Fem
----------
A*     46,
A      93
```

You will only need to make changes in the *printreportbysubject* function.

[15 marks]

Activity 4.2

The program to create the report has been coded (see file **task-4-2.py**) by a programmer, but it is difficult to read and understand. Improve the program to generate the comparison graphs for a subject to:

a) Use spacing to make the program easier to read.
b) Add comments to explain what the code is doing – for example, before any blocks of code where it isn't obvious what they do, and at the end of any more obscure commands.
c) Make the code robust by checking for erroneous input and empty results, and to allow subjects to be entered in lower case.

Your code should be annotated to help future maintenance of the code, but also to show where you should get marks.

Once your code is fully working and you have finished tidying up the code and laying out comments, use the following checklist to ensure you have covered the points that

Criteria
Have you carefully gone through every sentence in the task and checked that you have done what it says?
Have you indented your code in a way that is consistent with the original code?
Have you added any blocks of code that would be better put in a function?
Have you added some comments – in particular where there is a complex line of code, or to explain what a block of code or function does?
Have you used any global variables – if so, can you change them to local variables
Do all the user inputs have clear instructions?
Does the code cope with large values, and cater and not crash for any erroneous data that may be entered?
Are all the forms and outputs nicely laid out, with clear headings and labels?
Have you considered whether the solution is accessible to all types of user?
Was a logo or any other information provided or used in the solution that you should carry through to your updated solution?
Have you carried out testing to check that everything works?

Extension Activity

Make further improvements to the program to create a better and styled format. In programming, students instinctively spend too much time on making visual improvements getting the code to work properly, so set yourself a limited amount of time to make you can in that time.

Important

In Task 4a you are given up to 6 marks for your working code so it is important to test it properl
everything asked for.

If you can't code a full working solution don't worry as there are anoth 28 marks available; ther

- **3 marks for your logic and programming stru s**; w ch includes making good ch
and functions.
- **3 marks for robustness**; whi fast start-up, not crashing (including when un
entered or process a graceful shutdown.
- **6 r r s y**; which includes avoiding using global variables, avoiding data being
the rror message, and using specific panda data frames within functions rather tha
- **8 marks for code organisation**; which includes correct code indentation, sensible variabl
programming conventions.
- **8 marks for user experience**; which includes easy to use input forms with fields labelled,
explanations of what everything means, labelled tables and graphs, clear messages, and g
e.g. rounding numbers to appropriate numbers of decimal places and pound sign symbols

Task 4b: Reflective Evaluat

The good news is that whether you have made a perfect working solution in Task
struggled, you can still get full marks for this task.

You will have to come up with ideas of how the solution could be further develop

You are asked to **evaluate**. This means that as well as making your point, you ha
you are making that point, to get the marks.

If your working solution is perfect, then you can explain how your solution meets
working solution is not perfect, then you can explain what needs to be done to im
requirements.

Scenario

A program has been written in Python to ask a user how much money they want to borrow, what the interest rate is, and how much they want to pay back each month. Calculate and tell them how long it will take to pay off the loan and how much interest they will end up paying.
Here is an example run-through and the code:

```
Enter the loan amount: £
Enter the annual intere
Enter your monthly paym

It took 52 years and 2
 of £200,000.00 at 5.0%
This amount includes: £
```

```
# Function to calculate monthly loan amount
def monthly_calculation(loan, annual_interest_rate, payment):
    return loan * (1 + (annual_interest_rate / 100) / 12) - payment

# Get user input
loan_amount = float(input("Enter the loan amount: £"))
annual_interest_rate = float(input("Enter the annual interest rate (%): "))
payment = float(input("Enter your monthly payment: £"))

# Set up starting variables
running_loan_amount = loan_amount
month_counter = 0
total_paid = 0

# Repeatedly make the monthly payments until it is all paid off
while running_loan_amount > 0:
    running_loan_amount = monthly_calculation(running_loan_amount, annual_
    total_paid += payment
    month_counter += 1

# Display results
print(f"\nIt took {month_counter // 12} years and {month_counter % 12} month
      £{loan_amount:,.2f} at {annual_interest_rate}% interest.")
print(f"This amount includes: £{total_paid - loan_amount:,.2f} in interest.")
```

This code is also provided in file **task05-1.py**.

Evaluate how well the solution meets the requirements

To do this you should look at the brief, look at the code and look at the output fro
evaluation has been on the solution that you produced in Task 4a, so you will hav
code, including with extreme and erroneous data.

Start by highlighting each point in the brief and check that it has been carried out
the solution meets the requirements, so you should comment on whether it meet
not at all. Where it doesn't meet the brief or it can be improved, you can indicate
changed to improve it. There may also be opportunity to indicate where the prog
of meeting the brief; for example, if there is a complexity that has been coded we
erroneous user input or dividing by 0.

Look at the code and check, as far as you can, that it is correct. Look at the form
text to see if anything can be improved. Is the solution well explained; for examp
user to enter, and are the results explained?

Work through the code, making sure you understand what each line is doing, and
could be done to fix them:

- Check that the logic makes sense.
- Does the user input work for extreme data? For example, does numerical in
very large or very small numbers, and decimal points? Does strong input ca
long strings?
- Does the user input cater and not crash for erroneous data; for example, if a
prompted for a number?
- Do the loops exit correctly? Are there any situations when any loops could r

Understanding exactly how the code works is important because to achieve maxi
demonstrate a 'detailed understanding of how well the solution meets the requi
users' and you have to 'comprehensively support' your points with explanations.

Activity

How well does the code in the previous scenario meet the requirements of the b

'Ask a user how much money they want to borrow, what the interest rate is, and
back each month. Calculate and tell them how long it will take to pay off the loan
will end up paying.'

Run the code with simple examples to test; alternatively, run through the progra
table. For example, does it give the correct answer for when you borrow £150 a
back £100 a month? Also does it give the correct answer when you borrow £1,0

When you identify each error, also explain why the error has occurred, and what
code to cater for the error. Sometimes there are multiple solutions.

Tips (you will not be given these in the actual task):

- What erroneous input will crash the program?
- What extreme input will crash the program?
- What will cause the program to run forever (or at least until it runs ou
- Does it give the correct answer?

Evaluate how well the solution meets the needs of the user

Even if the program fully meets the brief, it still may be of limited use to the user, things the brief missed. Also, it may have been implemented in such a way that it work very well for the user.

If it meets the requirements and meets the needs of the user then say this and ex

Even if it meets all the requirements, and meets the needs of the user, in the limi to be further ways to meet the needs of the user. For example, you may be able t user interface.

If you have identified any fundamental problems with how well it meets the brie if it means the program won't fully meet the needs of the user, but you should als beyond the brief.

Activity 5.2

How well does the code for the previous scenario meet the needs of the user who tool because they are considering borrowing some money to buy a house?

Hints:

- Try to put yourself in the position that you want to borrow this money – doe information you need?
- Is there anything difficult about how you have to enter the input, or in how the

Evaluate how the solution could be further developed

This is a more open-ended question. You have had some time since doing Task 4a wisely to look at other similar programs and what they do.

Think about whether there is anything else along the same lines that it would be

Activity 5.3

Evaluate how the solution to this loan program could be developed further. The 'convincing and well-supported rationale'.

Hints:

- Activity 5.1 covered how well the program met the brief, and Activity 5.2 cov needs and why, so you don't need to cover these points again.
- You may give an answer for how the input could be improved, and how the c the examiner will be looking for developers beyond those points.
- Ensure that all your answers relate directly to the scenario.

If you are struggling for ideas, think about these points:

- Usually when you take out a loan, the bank doesn't ask you how much you w normally from you?
- What happens to the amount of interest you pay if you double the amount y doesn't double!) What could it therefore be useful to tell the user?
- How could a graphical user interface improve the user experience overall?

Solutions

Task 1: Planning a Project

Activity 1.1

2 marks *for sensible allocation of personnel to tasks.*
2 marks *for accurately calculating costs.*
2 marks *for a thorough and perceptive justification taking into account cost, risk, benefits*

Task	Estimated Hours	Total Estimated Hours	Personnel	Ju
Source supplier for cloud server	20	20	Anurag Acharya	Experience wi is too keen on technologies)
Install and set up cloud server	30	30	Galla Kumari	Their area of e
Testing of hardware	25	25	Anurag Acharya	Background in networking. G testing her ow prone to mista
Module 1: Create database and database queries needed for system	200	200	Amit Singhal	His area of exp
Module 2: Code data entry (with basic functional pages)	150	150	Ruchi Sanghvi	Strong coder
Module 3: Code analysis and reports	150	150	Ruchi Sanghvi	Strong coder
Module 4: Ad design elements in interface	80	80	Ruchi Sanghvi	Experienced c Kautilya show experienced t
Create a test plan	30	30	Amit Singhal	Trained in this
Unit testing	20 per module	80	Amit Singhal	Trained in this
Integration testing	30	30	Amit Singhal	Trained in this
Fixing and regression testing major faults	15 per fault	45	Ruchi Sanghvi	Strong coder a be quickest fix
Fixing and regression testing minor faults	5 per fault	200	Ruchi Sanghvi	Strong coder a be quickest fix
User/acceptance testing	15	15	Anurag Acharya	All-round expe project and go
User training	15	15	Anurag Acharya	All-round expe project and go although expe 15 hours
Customer support during char	30	30	Ruchi Sanghvi	Very familiar w personable
	hours	1100		

Preview of Answers Ends Here