

Trial exam DIGHEL4360, Fall 2022

This exam has 9 tasks, covering the four themes of Programming, Databases, Security, and Software development. The exam has been designed to be similar to a 4 hour written exam.

Theme 1 Programming

These tasks will test the students' code knowledge and ability to read and interpret code using the concepts taught in the lectures.

Task 1

We will now have a look at some basic concepts in programming. Consider this code, which is used by nurses and doctors at a hospital:

```
admitted = ["Lisa", "John", "Bill", "Georgia"]
discharged = ["Peter", "Elsa"]
patient = input("Enter the name of a patient to check: ")
if patient in admitted:
    print("This patient is currently at the hospital")
elif patient in discharged:
    print("This patient has been at the hospital and is discharged")
else:
    print("Unknown patient")
```

Task 1A

Explain in a few sentences the structure of the program and what it does.

Task 1B

This code uses some programming concepts that we know from this course. Explain in a few sentences what the following concepts are used for in a program:

- Input
- List

Task 1C

Take a look at the if-elif-else clause. Explain why we can safely assume that a patient is unknown if we don't enter the if or elif blocks.

Task 2

Take a look at the following program:

```
drug = input("Enter name of drug: ")
dosage = float(input("Enter the dosage: "))
time_passed = int(input("Enter number of half lives since administration: "))
for i in range(time_passed):
    dosage = dosage / 2
print("After", time_passed, "the patient has", dosage, "of", drug, "in plasma.")
```

Task 2A

A doctor enters 200 as dosage and 4 numbers of half lives passed. Given the program, what would the patient's level of the drug be in plasma?

Task 2B

Why did we use a for loop rather than a while loop in this program?

Task 2C

When reading the input, we used the float datatype for dosage and int for time passed. If we changed the datatype of time passed to float the program would no longer work. Explain why.

Task 3

A psychiatrist treating a patient with bipolar disorder wants to track the mood of a patient over five weeks. They have written a file named mood.csv containing numbers for the patients mood on a scale between 0 and 10, where 0 represents severe depression and 10 represents severe mania.

Each line represents one week:

```
9
7
5
5
4
```

You can answer the following questions as text, pseudo-code or Python code.

Task 3A

How would you open and read this file, storing each mood score as an int in a list?

Task 3B

The psychiatrist considers prescribing a mood stabilizer, but only if the patient's mood has been above 7 or below 3 during the five-week period. Design an algorithm that decides whether or not to prescribe medicine.

Task 3C

Design an algorithm that considers the first and last score in the list to decide whether the patient is more manic or more depressed at the last week of the period compared to the first week of the period.

Theme 2 Databases

Task 4

Given the following table containing data on projects and tasks:

project:

ProjectID	Name	Leader	Task	StartDate
1	Omega	Omar Nilsen	Planning	2022.09.01
1	Omega	Omar Nilsen	Construction	2023.03.10
2	Tunnel2	Turid Nelly	Startup	2022.11.10
1	Omega	Omar Nilsen	Finalizing	2023.11.01
2	Tunnel2	Turid Nelly	Make contract	2022.11.10
3	Seawind	Sean Winderly	Hire personnel	2023.01.01
3	Seawind	Sean Winderly	Start planning	2023.01.01

Where ProjectID is a unique ID for each project, Name is the name of the project, Leader is the person that is leading the project, Task is the name of a task associated with the project, and StartDate is the date that task is started.

Task 4A

What is wrong with the structure of the table?

Task 4B

How can these problems be fixed?

Task 5

Given the following table containing data on music albums:

album:

album_ID	name	artist	length	tracks
1	White Pony	Deftones	53	12
2	Abbey Road	The Beatles	47	17
3	Meta	Thy Catafalque	67	9
4	My Hero (single)	Foo Fighters	4	1
5	Greatest Hits	Queen	19	5
6	Yellow Submarine	The Beatles	39	13
7	A Night At The Opera	Queen	43	12
8	Fear Inoculum	Tool	87	10

9	Folkesange	Myrkur	47	12
10	Rituals (single)	Rolo Tomassi	4	1

Here album_id is a unique ID for each album, name is the name of the album, artist is the name of the artist that made the album, length is the play length in minutes for the album, and tracks is the number of tracks on the album.

Task 5A

What would the following query return?

```
SELECT name, length, tracks
FROM album
WHERE album_id = 2;
```

Task 5B

What would the following query return?

```
SELECT count(*) AS num_albums
FROM album
WHERE artist = 'The Beatles' OR length >= 60;
```

Task 5C

Write an SQL-query that finds the name of all albums with between 3 and 11 tracks.

Task 5D

Write an SQL-query that finds the average length and average number of tracks for all albums made by Queen.

Task 5E

Write an SQL-query that finds the name and length, in seconds, of all albums a length longer than 1000 seconds.

Theme 3 Security

Task 6A

Which of the following definitions (from the NIST) defines the term “confidentiality”:

1. ... means ensuring timely and reliable access to and use of information.
2. ... means guarding against improper information modification or destruction, and includes ensuring information non-repudiation and authenticity.
3. ... means preserving authorized restrictions on access and disclosure, including means for protecting personal privacy and proprietary information.

Task 6B

Mark the statement(s) about the Diffie-Hellman Key Exchange (DHKE) that are true.
One or more options might be correct.

1. DHKE was invented in the middle age
2. DHKE ensures authenticity, i.e., to identify the sender
3. DHKE allows to exchange a key that can then be used for symmetric encryption
4. Before DHKE, symmetric encryption was not possible

Task 6C

Please explain what phishing is.

Task 6D

TLS (which is also used in HTTPS) uses certificates. Mark the statements that are true.

1. A certificate authority issues a certificate only to the rightful owner of the domain.
2. A certificate shows that the Web page is trustworthy
3. The certificate (used in a TLS connection) guarantees authenticity.
4. Certificates are available free of charge.

Theme 4 Software development

For the following tasks, please write no longer than 1000 words combined

Task 7

What are some potential benefits of agile software development compared to plan-driven “waterfall” software development?

Task 8

What is “sociotechnical design” in relation to IT and digitalization projects? What can be different forms or scopes of design in such projects?

Task 9

When an organization is in need of a new IT system, we often say that they have the choice of “buy versus build.” For instance, the Central Norway Regional Health Authority (Helse Midt-Norge) made the choice of “buy” for their new patient journal system. Elaborate briefly on what this means and discuss some pros and cons of the two choices.