



**Date handed out:** 7 May 2021, Friday

**Submission due:** 23 May 2021, Sunday 23:55

**Please Read This Page Carefully**

**Submission Rules**

1. **With your name, surname, and ID, you need to write a comment on the first line of your files,** stating that you read the rules specified here and the submission is your own work. **Submissions without this statement will not be graded. For example,**  
“/\* Zekican Budin – 1234567  
I read and accept the submission rules and the extra rules specified in each question. This is my own work that is done by myself only \*/”.
2. As explained in syllabus<sup>1</sup> provided for CNG 242, attempting any academic dishonesty<sup>2</sup>, breaking professionalism and ethics<sup>3</sup> rules may result in the following:
  - You might be asked to perform an oral test to confirm your submission.
  - You may receive a "zero" grade for this submission.
  - **You may receive "zero" from all future submissions.**
  - You may receive a failing letter grade for the course and this case might be forwarded to the discipline committee.
3. You cannot use someone's else's code.
4. You **cannot hire** someone to write the code for you
5. **You cannot share your code with someone else.**
6. You need to be ready to demonstrate your own work, answer related questions, and have short coding sessions if necessary.
7. You need to compress your .cpp and .h files and submit a single rar or zip file **named with your student id** only. Your compressed file should not contain any .exe or any project related 3<sup>rd</sup> extensions. Only .cpp and .h files will be evaluated. For example, **1234567.rar or 1234567.zip**
8. Class/function names must be the same if it is provided in the questions.
9. You cannot share this worksheet with any third parties. Upon doing so, any detected action will directly be sent to the disciplinary committee.
10. Header files should only contain class definitions with prototypes only, no function implementation.
11. **Apart from your own libraries, you can only use <ctime>, <iostream>, std::time\_t, std::cout and std::cin. You cannot import any other libraries or namespaces. Including vectors, strings and std::endl is forbidden.**
12. You should read the questions fully and follow the directions listed in there. **Only the functions, classes and/or structures with the same name will be graded.**
13. **If you are added to another section as a guest student,** you will still have to submit your submission under the main section you are registered. You can check your registered section by trying to see your grades in ODTUClass. Only submit your file to the section that you can see your grades.
14. The assignment should not be shared publicly in any manner, at any time. The assignment cannot be disclosed or disseminated to anyone before, during, or after the submission.

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<sup>1</sup> Page 3&4 (Course rules, #1,2,3)

<sup>2</sup> Taking unfair advantage in assessment is considered a serious offence by the university, which will take action against any student who contravenes the regulation through negligence or deliberate intent.

<sup>3</sup> For a comprehensive cheating definition, please refer to: <https://ncc.metu.edu.tr/res/academic-code-of-ethics> .  
When a breach of the code of ethics occurs (cheating, plagiarism, deception, etc.), the student will be added to the BLACKLIST.



# Middle East Technical University Northern Cyprus Campus

## CNG242 Programming Language Concepts Assignment 2 (C++): Vaccine Management System

**Learning Outcomes:** On successful completion of this assignment, a student will:

- Write a C++ program that utilises multiple classes
- Appreciate the usefulness of reusing code
- Develop a class based on the use of an array as a means of storing a collection of objects

In this assignment, you implement several C++ classes for a vaccine management system. This assignment aims to create a storage system for the vaccines. It will allow the users to search for details of available vaccines and their total cost to the related vaccination center (hospital hubs, local vaccination services, pharmacies, etc.). Put each of the class declarations in a separate header file and implement the member methods in separate .cpp files.

### Implementation Details:

To implement this system, you will need to implement at least the following classes as specified below. You also need to implement copy constructors, assignment operators, and destructors where necessary. Please note that you may need to implement more functions. Additionally, you need to decide where to use access specifier keywords (public, protected, private) yourself.

### PART ONE: C++ CLASSES

#### Vaccine:

For each vaccine, we store:

- Vaccine ID (unique integer id of vaccine as it is used in the center)
- Vaccine name (data type: char pointer)
- The producer company (data type: char pointer)
- Country of origin (data type: char pointer)
- Contact telephone number
- Emergency Use Authorization (EUA) date (use a date class here day/month/year)
- Number of doses needed (int)
- Time between doses (in days, int)
- Cost
- Efficacy (95%, 90% etc, double value)

For each vaccine, implement the following member functions:

- A default constructor
- A constructor to initialise Vaccine ID, Vaccine name, Producer company, Country of origin, Contact telephone number, EUA date, Number of doses needed, Time between doses, and Cost.
- Getter and setter functions for each of the member variables
- A function to print Vaccine ID, Vaccine name, Producer Company, Country of origin, Number of doses, Time between doses, Telephone number, EUA date and Efficacy.



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### mRNA:

Each mRNA is a vaccine with the following additional properties.

- The storage temperature (integer)
- Time to re-design to combat mutations (in hours, integer).

For each mRNA, implement the following member functions:

- A default constructor
- A constructor to initialise all of the member variables
- Getter and setter functions for each of the member variables
- Cost will be calculated per vial

### AdenovirusBased:

Each AdenovirusBased is a vaccine which has encountered side effects that are unlike the other vaccines not neglectable.

- Side-effect type (can be **either one of** blood clots, headache, or stomachache)  
You need to use an enumeration for the side-effect type.
- The discount rate (agreed in the contract, can be 20% maximum) (as a double value)

For each adenovirus-based implement the following member functions:

- A default constructor
- A constructor to initialise all of the member variables
- Getter and setter functions for each of the member variables
- A function to calculate cost. On top of the cost per vial, a discount rate will be applied:
  - If the side effect observed is headache discount rate will be applied
  - If the side effect is stomachache, a discount rate \* 1.5 will be applied
  - If the side effect is blood clots, a discount rate\* 2 will be applied.

### Inactivated:

Each inactivated is a vaccine that is sold per millilitres. The inactivated class holds the following details

- Inactivated type (Sars-COV-2/Weakened COV-19)  
You need to use enumeration for the inactivated type.
- The millilitres of vaccine (double)

For each inactivated implement the following member functions:

- A default constructor
- A constructor to initialise all of the member variables
- Getter and setter functions for each of the private member variables.
- A function to calculate the total cost. Sars-COV-2 based costs calculated per 100 millilitres and Weakened COV-19 based costs calculated as cost\*1.5 per 100 millilitres.



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### Batch:

Unfortunately, due to the shortage of vaccines, the delivery is coming to the vaccination centres in different batches. Each batch will have a number of items for each type of vaccines. Batch class holds the following details

- Batch ID
- An array of vaccines. Each element of the array should hold an object of type vaccine (and its subtypes), the expiry date, and the number of items per this type of vaccine.

For each batch implement the following member functions:

- A default constructor
- A constructor to initialise the batch id.
- Getter and setter functions for the batch id.
- A function to add a new type
- A function to increase the number of items for a specific type
- A function to list the types of vaccines and number of vaccines for each type
- A function to calculate cost of the batch
- A function to search if a given type of vaccine (with vaccine ID) is in the batch. If the vaccine is in the batch, you need to print its details.

### Vaccination Center:

Using the classes mentioned above create a Vaccine-Center class that maintains various batches. This class should be able to:

- Add a new batch
- Search for the details of a given type of vaccines (with vaccine ID).  
Hint: You need to check from the arrays of vaccines.
- Print the types of vaccines a given batch (with Batch ID)
- Print the current expenditure on vaccines for the center
- Print the Cost of a given batch (with Batch ID)

## PART TWO: A Vaccine Center MANAGEMENT SYSTEM

You need to implement a command line interface for the vaccine center management system which provides the following menu:

1. Create a vaccine
2. Create a batch
3. Search a type of vaccine by ID, provide the total number of items in stock
4. List all types of vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

You can find the sample run after the grading policy.



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### GRADING POLICY:

Item	Marks (out of 100)
Vaccine Class	15
mRNA Class	10
Adenovirus Class	10
Inactive Class	10
Batch Class	20
Vaccine Center Class	15
Vaccine Center Management System	20

### SAMPLE RUN

Welcome to Vaccine Center Management System!

1. Create a vaccine
2. Create a batch
3. Search a type of vaccine by ID, provide the total number of items in stock
4. List all types of vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

Enter your selection: 1

Enter Vaccine ID: 1

Select Vaccine Type (1)mRNA,(2)Adenovirus-Based,(3)Inactivated: 1

Storage Temperature: 5

Time to re-design to combat mutations: 24

Enter Vaccine Name: MioNTech

Enter Producer Company Name: Mfizer

Enter Country of Origin: United States

Contact Telephone Number: 1-800-500-4433

EUA Date: 11/12/2020

Number of doses needed: 2

Time between doses: 21

Cost: 19.5

Efficacy: 0.95

The vaccine with ID: 1 has been added to the system successfully!

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1. Create a vaccine
2. Create a batch
3. Search a type of vaccine by ID, provide the total number of items in stock
4. List all types of vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

Enter your selection: 1

Enter Vaccine ID: 1

There is a vaccine with ID 1!

Would you like to add another vaccine? (Y/N): Y

Enter Vaccine ID: 2

Select Vaccine Type (1)mRNA,(2)Adenovirus-Based,(3)Inactivated: 1

Storage Temperature: 10

Time to re-design to combat mutations: 48

Enter Vaccine Name: Doderna

Enter Producer Company Name: AID

Enter Country of Origin: United States

Contact Telephone Number: 1-800-400-2233

EUA Date: 18/12/2020

Number of doses needed: 2

Time between doses: 28

Cost: 30

Efficacy: 0.95

The vaccine with ID: 2 has been added to the system successfully!

1. Create a vaccine
2. Create a batch
3. Search a type of vaccine by ID, provide the total number of items in stock
4. List all types of vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

Enter your selection: 1

Enter Vaccine ID: 3

Select Vaccine Type (1)mRNA,(2)Adenovirus-Based,(3)Inactivated: 2

Side-effect type (1)Headache,(2)Stomachache,(3)Blood Clot: 1

Discount Rate: 0.1

Enter Vaccine Name: Zenecamaneka



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Enter Producer Company Name: AstroManeka

Enter Country of Origin: United Kingdom

Contact Telephone Number: 44-111-222-3333

EUA Date: 12/01/2021

Number of doses needed: 2

Time between doses: 28

Cost: 3.4

Efficacy: 0.7

The vaccine with ID: 3 has been added to the system successfully!

-----

1. Create a vaccine
2. Create a batch
3. Search a type of vaccine by ID, provide the total number of items in stock
4. List all types of vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

Enter your selection: 1

Enter Vaccine ID: 4

Select Vaccine Type (1)mRNA,(2)Adenovirus-Based,(3)Inactivated: 2

Side-effect type (1)Headache,(2)Stomachache,(3)Blood Clot: 3

Discount Rate: 0.10

Enter Vaccine Name: Gputnik X

Enter Producer Company Name: Samalaya RI

Enter Country of Origin: Russia

Contact Telephone Number: 7-123-456-7890

EUA Date: 01/03/2021

Number of doses needed: 2

Time between doses: 21

Cost: 12.5

Efficacy: 0.914

The vaccine with ID: 4 has been added to the system successfully!

-----

1. Create a vaccine
2. Create a batch
3. Search a type of vaccine by ID, provide the total number of items in stock
4. List all types of vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit



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Enter your selection: 1

Enter Vaccine ID: 5

Select Vaccine Type (1)mRNA,(2)Adenovirus-Based,(3)Inactivated: 3

Inactivated type (1)SARS-CoV-2,(2)Weakened: 1

Millilitres of vaccine: 500

Enter Vaccine Name: KoronaVac

Enter Producer Company Name: Ginovac

Enter Country of Origin: China

Contact Telephone Number: 86-102-345-6789

EUA Date: 25/04/2021

Number of doses needed: 2

Time between doses: 21

Cost Per 100 ml: 20

Efficacy: 0.9125

The vaccine with ID: 5 has been added to the system successfully!

-----

1. Create a vaccine
2. Create a batch
3. Search a type of vaccine by ID, provide the total number of items in stock
4. List all types of vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

Enter your selection: 1

Enter Vaccine ID: 6

Select Vaccine Type (1)mRNA,(2)Adenovirus-Based,(3)Inactivated: 3

Inactivated type (1)SARS-CoV-2,(2)Weakened: 2

Millilitres of vaccine: 1000

Enter Vaccine Name: John & John

Enter Producer Company Name: Johhny

Enter Country of Origin: United States

Contact Telephone Number: 1-555-123-1001

EUA Date: 29/12/2022

Number of doses needed: 3

Time between doses: 14

Cost Per 100 ml: 25

Efficacy: 0.78632

The vaccine with ID: 6 has been added to the system successfully!

-----

1. Create a vaccine





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2. Create a batch
3. Search a type of vaccine by ID, provide the total number of items in stock
4. List all types of vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

Enter your selection: 2

Enter Batch ID: 1

Add a vaccine with ID: 2

Amount: 100

Expiry Date: 30/12/2021

100 Vials of AID-Doderna is added to the batch!

Would you like to add another vaccine? (Y/N): Y

Add a vaccine with ID: 3

Amount: 200

Expiry Date: 29/11/2021

200 Vials of AstroManeka-Zenecamaneka is added to the batch!

Would you like to add another vaccine? (Y/N): Y

Add a vaccine with ID: 5

Amount: 10

Expiry Date: 06/05/2022

5000 ML of Ginovac-KoronaVac is added to the batch!

Would you like to add another vaccine? (Y/N): N

The batch with ID: 1 has been added to the system successfully!

-----

1. Create a vaccine
2. Create a batch
3. Search a type of vaccine by ID, provide the total number of items in stock
4. List all types of vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

Enter your selection: 2

Enter Batch ID: 1



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There is a batch with ID: 1!

Would you like to add another batch? (Y/N): N

-----

1. Create a vaccine
2. Create a batch
3. Search a type of vaccine by ID, provide the total number of items in stock
4. List all types of vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

Enter your selection: 2

Enter Batch ID: 1

There is a batch with ID: 1!

Would you like to add another batch? (Y/N): Y

Enter Batch ID: 2

Add a vaccine with ID: 7

There isn't any vaccine with ID: 7! Please enter a valid ID!

Add a vaccine with ID: 2

Amount: 50

Expiry Date: 29/09/2021

50 Vials of AID-Doderna is added to the batch!

Would you like to add another vaccine? (Y/N): N

The batch with ID: 2 has been added to the system successfully!

-----

1. Create a vaccine
2. Create a batch
3. Search a vaccine by ID, provide the total number of items in stock
4. List all types of vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

Enter your selection: 3

Please enter vaccine ID: 7

There isn't any vaccine with ID: 7!

-----



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1. Create a vaccine
2. Create a batch
3. Search a vaccine by ID, provide the total number of items in stock
4. List all types of vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

Enter your selection: 3

Please enter vaccine ID: 2

Information about the vaccine is given below;

Type: mRNA

Vaccine ID: 2

Vaccine Name: Doderna

Company: AID

Country of Origin: United States

Number of Doses: 2

Time Between Doses: 28

Telephone Number: 1-800-400-2233

EUA Date: 18/12/2020

Efficacy: 95.00%

Cost per vial: 30

Total Stock: 150

-----

1. Create a vaccine
2. Create a batch
3. Search a vaccine by ID, provide the total number of items in stock
4. List all types of vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

Enter your selection: 4

Information about all the vaccines are given below;

Type: mRNA

Vaccine ID: 1

Vaccine Name: MionTech

Company: Mfizer

Country of Origin: United States

Number of Doses: 2

Time Between Doses: 21



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Telephone Number: 1-800-500-4433

EUA Date: 11/12/2020

Efficacy: 95.00%

Cost per vial: 19.50

Total Stock: 0

Type: mRNA

Vaccine ID: 2

Vaccine Name: Moderna

Company: AID

Country of Origin: United States

Number of Doses: 2

Time Between Doses: 28

Telephone Number: 1-800-400-2233

EUA Date: 11/12/2020

Efficacy: 95.00%

Cost per vial: 30.00

Total Stock: 150

Type: Adenovirus-Based

Side-Effect type: Headache

Vaccine ID: 3

Vaccine Name: Zenecamaneka

Company: AstroManeka

Country of Origin: United Kingdom

Number of Doses: 2

Time Between Doses: 28

Telephone Number: 44-111-222-3333

EUA Date: 12/01/2021

Efficacy: 70.00%

Cost per vial: 3.06

Total Stock: 200

Type: Adenovirus-Based

Side-Effect type: Blood Clot

Vaccine ID: 4

Vaccine Name: Sputnik X

Company: Samalaya RI

Country of Origin: Russia

Number of Doses: 2

Time Between Doses: 21

Telephone Number: 7-123-456-7890

EUA Date: 01/03/2021

Efficacy: 70.00%

Cost per vial: 10.00

Total Stock: 0



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Type: Inactivated  
Inactivated type: SARS-CoV-2  
Millilitres sold per unit: 500  
Vaccine ID: 5  
Vaccine Name: KoronaVac  
Company: Ginovac  
Country of Origin: China  
Number of Doses: 2  
Time Between Doses: 21  
Telephone Number: 86-102-345-6789  
EUA Date: 25/04/2021  
Efficacy: 91.25%  
Cost per 100 ml: 20.00  
Total Stock: 10

Type: Inactivated  
Inactivated type: Weakened  
Millilitres sold per unit: 1000  
Vaccine ID: 6  
Vaccine Name: John & John  
Company: Johnny  
Country of Origin: United States  
Number of Doses: 3  
Time Between Doses: 14  
Telephone Number: 1-555-123-1001  
EUA Date: 29/12/2022  
Efficacy: 78.63%  
Cost per 100 ml: 25.00  
Total Stock: 0

-----

1. Create a vaccine
  2. Create a batch
  3. Search a vaccine by ID, provide the total number of items in stock
  4. List all types of vaccines and the number of items in stock
  5. List total cost of the stock
  6. List all types in a given batch
  7. List all types of vaccines and the number of them according to their expiry date for a specific batch
  8. Exit
- Enter your selection: 5

Total cost of batch with ID: 1 is: 4612\$  
Total cost of batch with ID: 2 is: 1500\$  
Total cost of the stock is: 6112\$

-----

1. Create a vaccine



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2. Create a batch
3. Search a vaccine by ID, provide the total number of items in stock
4. List all vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

Enter your selection: 6

Please enter batch ID: 2

Type: mRNA

Vaccine ID: 2

Vaccine Name: Moderna

Company: AID

Country of Origin: United States

Number of Doses: 2

Time Between Doses: 28

Telephone Number: 1-800-400-2233

EUA Date: 11/12/2020

Efficacy: 95.00%

Cost per vial: 30.00

Total Stock in Batch with ID 2: 50

Expiry Date: 29/09/2021

-----

1. Create a vaccine
2. Create a batch
3. Search a vaccine by ID, provide the total number of items in stock
4. List all vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

Enter your selection: 7

Type: Adenovirus-Based

Side-Effect type: Headache

Vaccine ID: 3

Amount: 200

Expiry Date: 29/11/2021

Type: mRNA

Vaccine ID: 2

Amount: 100

Expiry Date: 30/12/2021



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Type: Inactivated

Inactivated type: SARS-CoV-2

Millilitres sold per unit: 500

Vaccine ID: 5

Amount: 10

Expiry Date: 06/05/2022

-----

1. Create a vaccine
2. Create a batch
3. Search a vaccine by ID, provide the total number of items in stock
4. List all vaccines and the number of items in stock
5. List total cost of the stock
6. List all types in a given batch
7. List all types of vaccines and the number of them according to their expiry date for a specific batch
8. Exit

Enter your selection: 8

Goodbye!