**Option A (Databases)**

Computer Room Registration System

The computer rooms in a college are open for students to use during lunch time and after lessons. The college is planning to develop a registration system so that the usage records of the computer rooms can be kept.

A draft ER diagram of the registration system is shown below:

Use

Computers

M

Students

N

Task 1 (Design & Implementation)

Create a prototype of the DBMS of the registration system for the college with the completion of following subtasks:

1. Complete the ER diagram. You may:

* add new entities,
* resolve the many-to-many relation,
* add necessary attributes, and
* normalise the database design.

1. Define the data dictionary of the database tables involved.
2. Write at least three SQL commands to provide statistical information for the college.

You may want to consider some of the following key factors when designing the prototype:

* three levels of data abstraction, namely conceptual level, physical level and view level
* relational database design
* data redundancy
* data integrity
* SQL implementation
* user-friendliness
* needs and trends for future development

Create a presentation and/or documents to briefly describe the components involved in designing the prototype.

Task 2 (Testing & Evaluation)

Referring to the prototype of the DBMS (*Alternative: Using the prototype of a DBMS stipulated by your teacher*), complete the following tasks.

Conduct a test of the prototype. Collect and record the feedback and results of the test.

Either (i) make one major change in the database design and illustrate the corresponding improvement,

or (ii) describe how the scope of the prototype could be extended.

Create a presentation and/or documents to illustrate the database schema. You may want to consider some of the following items:

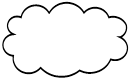
* pros and cons of the database design
* concept of relational database
* database security
* data privacy issues
* data validation and verification
* impact of database development on society

**Option B (Data Communications and Networking)**

Cinema Ticketing System

ABC Cinema is planning to sell its tickets through its web site, the ticket office and self-service ticketing kiosks, as shown in the following diagram. The web site service is supported by the ticketing system of the cinema. The self-service ticketing kiosks are connected to the ticketing system through wireless connections. All the sales information is stored in a centralised database server.

ABC Cinema



Internet

Server Room

Web Server

Database Server

S

S

Lobby

Ticket Office

. . .

5 Ticketing Kiosks

. . .

5 Ticketing Computers

K

K

C

C

K

C

Key: Kiosks Computers Server

S

Task 1 (Design & Implementation)

Design the network for the ticketing system with the completion of the following subtasks:

1. Propose a suitable physical topology and set up the network through installing suitable network connecting devices and transmission media.
2. Propose suitable IP addresses and network services.
3. Make the services provided by the cinema accessible through the Internet.
4. Apply an appropriate access control measure to protect the data.

Create a prototype of the network design for ABC Cinema, focusing on the ticketing service. You may want to consider some of the following key factors when designing the prototype:

* types of network connection
* network infrastructure design
* IP address management
* access control and data security
* cost of network setup
* network monitoring
* network backup solution
* other special network requirements

Create a presentation and/or documents to briefly describe the components involved in designing the prototype.

Task 2 (Testing & Evaluation)

Referring to the prototype of the network design (*Alternative: Using the prototype of a network design stipulated by your teacher*), complete the following tasks.

Conduct a test of the prototype. Collect and record the feedback and results of the test.

Either (i) make one major change in the network infrastructure design and illustrate the corresponding improvement,

or (ii) describe how the scope of the prototype could be extended.

Create a presentation and/or documents to illustrate the network infrastructure. You may want to consider some of the following items:

* pros and cons of the network design
* resources and steps involved in the network setup
* network management and monitoring
* simple fault diagnostic flow charts
* system test plan
* system acceptance checklists

**Option C (Multimedia Production and Web site Development)**

Childhood Story Web site

ABC Kindergarten is planning to develop a childhood story web site so that the parents can make use of the web site to tell stories to their children. Below is the layout design of a web page on the web site:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  | | --- | | Navigation Menu |      |  |  | | --- | --- | | (Story Animation)  ☼  🏠☺ | (Text version of the story) | | |  |  |  |  |  | | --- | --- | --- | --- | --- | | ☺ |  | 🕵 |  | 🗣 |   (Thumbnails of the main characters) | |

Task 1 (Design & Implementation)

Create the following multimedia components for the web site:

1. attractive animations to illustrate the story.
2. thumbnails of the main characters by cropping images.
3. the background music of a web page by extracting the audio part of a video file.

With the above multimedia components, create a prototype of the web site with one or more web pages. The prototype should

* have a suitable colour scheme,
* include a site map for navigation, and
* incorporate accessibility measures.

You may want to consider some of the following key factors when designing the prototype:

* web site structure
* audience awareness and friendliness
* sitemap
* the use of multimedia elements
* hardware, platform, language and colour compatibility
* web accessibility
* interactivity
* different web designs, such as print version and responsive design

Create a presentation and/or documents to briefly describe the components involved in designing the prototype.

Task 2 (Testing & Evaluation)

Referring to the prototype of the web site (*Alternative: Using the prototype of a web site stipulated by your teacher*), complete the following tasks.

Conduct a test of the prototype. Collect and record the feedback and results of the test.

Either (i) make one major change in the web page design and illustrate the corresponding improvement,

or (ii) describe how the scope of the prototype could be extended.

Create a presentation and/or documents to illustrate the web site. You may want to consider some of the following items:

* pros and cons of the web site design
* how the editing of the multimedia elements compromises the environmental factors of the web site
* how the prototype addresses the key factors of a good web site
* how the evaluation of the prototype can help to improve the web site

**Option D (Software Development)**

Shift Cipher Decrypter

Shift cipher is a simple encryption method. When encrypting a message, every letter in the original message is replaced by a different letter *k* positions down the alphabet (modulo by 26), where *k* is an integer.

In the following example for *k* = 8,

Original message: WORK HARD, PLAY HARD!

🡫 Shifting *k* positions down the alphabet (modulo by 26)

Cipher text: EWZS PIZL, XTIG PIZL!

Note:

1. Assume that the message only contains upper case letters, space characters and punctuation marks.
2. Space characters and punctuation marks remain unchanged during the encryption.

A shift cipher decrypter can guess the message without knowing *k*. If a message is long enough, the most frequent letter will be ‘E’.

Task 1 (Design & Implementation)

Write a program to implement the shift cipher decrypter. You are advised to run your program with a message of at least 200 words such that the alphabet distribution follows the general pattern. Do the following tasks:

1. Select suitable data types.
2. Count the letter frequencies of the cipher text.
3. Find the possible values of *k* .
4. By using stepwise refinement, describe the algorithms for decryption.
5. Use a flowchart to describe the algorithms in (d).

You may want to consider some of the following key factors when designing the program:

* data structure
* variable declaration and initialization
* data collection, input and validation
* data processing
* program output
* interface of the program
* modularity
* reusability
* portability
* system development cycle
* sorting and searching algorithm

Create a presentation and/or documents to briefly describe the components involved in designing the program.

Task 2 (Testing & Evaluation)

Referring to the program (*Alternative: Using a program stipulated by your teacher*), complete the following tasks.

Conduct a test of the program. Collect and record the feedback and results of the test.

Either (i) make one major change in the program and illustrate the corresponding improvement,

or (ii) describe how the scope of the program could be extended.

Create a presentation and/or documents to illustrate the development of the program. You may want to consider some of the following items:

* pros and cons of the program design
* test cases
* unit test
* system test
* user acceptance test
* algorithm optimization