**Option A (Databases)**

Bicycle Sharing System

BSS, a bicycle sharing company, is planning to develop a mobile application for members to rent bicycles. By scanning a QR code printed on the bicycles, the mobile application can read the identity code of the bicycle and the corresponding bicycle will be unlocked for use. The rental fee is charged from the deposit of member accounts. The mobile application can show the locations of bicycles on a map based on the bicycles’ GPS coordinates (e.g. 22.276, 114.173). Below is a screen layout design of the mobile application.

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| **≡** | **BSS** |
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| |  | | --- | | Scan QR Code | | |

Task 1 (Design & Implementation)

Create a prototype of the DBMS of the mobile application. The prototype should include:

* an ER diagram and the corresponding database schema,
* the data dictionary of the database tables involved, and
* at least three SQL commands to provide useful information for the mobile application.

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)**

Modernisation of Sports Ground

ABC Sports Ground is planning to build a computer network to automate the score calculation during sports days. To record results of events, tablet computers and notebook computers will be used in field events and track events respectively. All records will be sent to a server for processing through the network. Scores of groups and individuals will be shown instantly on information panels located in the spectator stands.

Recording Points for Track Events

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Key: Server Information Panel Tablet Computer Notebook Computer

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Spectator Stands

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Field

Recording Points for Field Events

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Record Room

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Track

Task 1 (Design & Implementation)

Create a prototype of the network design for ABC Sports Ground, focusing on the overview of the network services. The prototype should include:

* network topology, transmission media and network connecting devices
* IP address arrangement
* network stability and reliability

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)**

Self-Directed Learning Web Site

ABC School is planning to provide a self-directed learning web site. Below is the sitemap of the web site:

Task 1 (Design & Implementation)

Create a prototype of the web site with one or more web pages. The prototype should include

* a carousel to display the updated news of the web site
* a short learning video
* auto-graded tests created by dynamic web authoring techniques
* user-friendly navigation
* suitable layout designs for desktop computers and mobile devices

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 helps to improve the web site

**Option D (Software Development)**

Inter-School Chinese Chess Competition

An inter-school Chinese chess competition will take place using a knock-out system, where the loser of each match will be eliminated and the winner will continue to compete for the award. Each school can enter at most two players in the competition. The semi-finalists (the best four players) of the competition last year are treated as seed players. They will not be scheduled to play against each other in the early stages as far as possible.

If the number of participants is not a power of 2, ‘byes’ are used to move certain participants to the next round automatically.

A sample of a competition chart for the Inter-School Chinese Chess Competition is shown below:

\* Seed players

A proper competition chart should

* separate the players from the same school as far as possible,
* separate seed players as far as possible, and
* balance the number of ‘byes’ in the chart such that a ‘bye’ occurs in the first round only.

Task 1 (Design & Implementation)

Write a program to produce the competition chart.

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 algorithms

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
* algorithms optimization