

Hong Kong Diploma of Secondary Education Examination 2019
Information and Communication Technology
School-based Assessment (20%)

SBA Requirements

The SBA component consists of two guided tasks, which comprises 20% of the subject mark. The guided tasks focus on ‘Design & Implementation’ and ‘Testing & Evaluation’ in the development of an information system:

- **Task 1: Design & Implementation (25 marks)**
- **Task 2: Testing & Evaluation (15 marks)**

Students should follow the guidelines and assessment criteria stipulated by their teachers to complete the project assignment. Students should define the scope of the project carefully, produce a program and write a report to record the project work. Students can select a project title from the following suggested titles.

Some Suggested Titles:

1. Composition Analyzer

(http://www.hkeaa.edu.hk/en/sba/sub_info_sba/dse_subject.html?16&4)

A composition analyzer is an analysis tool used by English teachers to generate statistical information about English compositions written by students. It is a program that can evaluate the quality of English compositions. Some examples of statistical functions of the composition analyzer are shown below:

- frequencies of letters
- frequency of a given word/expression
- total number of words
- total number of paragraphs

Task 1 (Design & Implementation)

Create and define the following components of the problem-solving procedures of the above program.

- (a) Select data types for two of the statistical functions mentioned above.
- (b) By using stepwise refinement, describe an algorithm for calculating the frequencies of letters.
- (c) Use a flowchart to describe the algorithm in (b).

Write a program to implement the composition analyzer with not more than four statistical functions with a plain text format for input, an analysis report for output and samples of English compositions for program testing. You may 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

Create a report (document) to briefly describe the components involved in designing the program.

Task 2 (Testing & Evaluation)

Referring to the program, 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 report (document) to illustrate the development of the program. You may consider some of the following items:

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

2. Seating Plan

(http://www.hkeaa.edu.hk/en/sba/sub_info_sba/dse_subject.html?16&4)

ABC school is going to organise a dinner for alumni to celebrate its 50th Anniversary. The school will develop a program for the dinner registration and generating a seating plan. During the data collection stage, the personal information of the participants will be input into the program, as shown in the following example:

- name of participant
- year of graduation
- sex
- age
- employment
- number of seats required

Task 1 (Design & Implementation)

At the end of the registration period, the program should generate a seating plan for the dinner and store it in a text file. You should clearly define the seat allocation rules and other system parameters such as table size. Some possible seat allocation rules are as follows:

- grouping family members together
- balancing male and female participants
- grouping participants of similar age
- grouping participants of similar employment

The program should follow at least **two** seat allocation rules at the same time when generating a seating plan. You should note that there may not be a perfect seating plan that follows all the stated rules. An approximate seating arrangement is acceptable. You may 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

Write the program for ABC school and create a report (document) to briefly describe the components involved in designing the program.

Task 2 (Testing & Evaluation)

Referring to the program, 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 report (document) to illustrate the development of the program. You may consider some of the following items:

- pros and cons of the program design
- test cases
- unit test
- system test
- user acceptance test
- algorithms optimization

3. Shift Cipher Decrypter

(http://www.hkeaa.edu.hk/en/sba/sub_info_sba/dse_subject.html?16&4)

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:

- (a) Select suitable data types.
- (b) Count the letter frequencies of the cipher text.
- (c) Find the possible values of k .
- (d) By using stepwise refinement, describe the algorithms for decryption.
- (e) 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 report (document) 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 report (document) 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

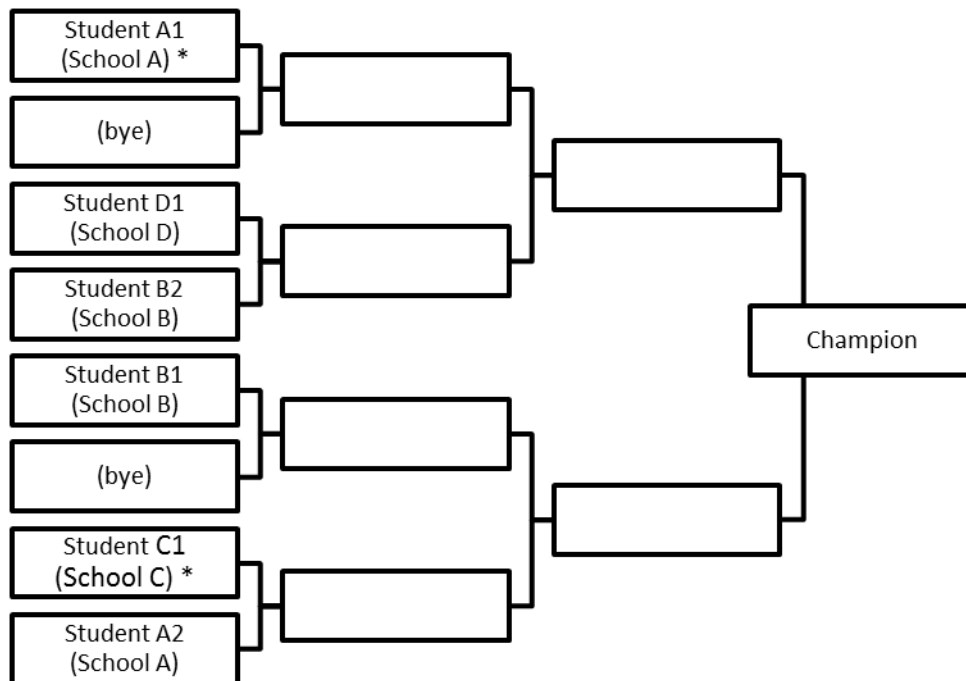
4. Inter-School Chinese Chess Competition

(http://www.hkeaa.edu.hk/en/sba/sub_info_sba/dse_subject.html?16&4)

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 report (document) 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 report (document) 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

5. Puzzle Games

A Puzzle & Games Society would like to design a system that provides various puzzle games for children to play. Some examples of puzzle games are Mastermind, Blackjack, Tic-tac-toe, Sudoku, etc. Some basic requirements are as follows:

- The system should provide at least three puzzle games
- The basic rules of each game should be clearly defined in the game
- Each game may have several levels of difficulties
- Login function may be provided to authenticate the users
- The scores of users may be recorded.

You are the IT project manager responsible for the project. You are going to provide solutions for the club.

6. CIT 2009: Multiple-Choice Analysis Report

An inter-school ICT competition, in the form of multiple-choice questions, has been organised. The answer sheets for participants will be read by using an Optical Mark Recognition (OMR) system, and the options selected were converted into a text file.

Imagine you are a programmer. You are going to develop a computer program to read all raw text-based data and produce a detailed analysis report on the competition. The analysis report should include:

- Total number of participants, total number of participating schools and total number of participant(s) from each participating school
- Winners of individual awards and school awards
- Question analysis, such as the percentage correct for each question

Candidates are required to write a program to generate the analysis report. The coursework should:

- Describe the required plain text data files, including the keys of the multiple-choice questions and their format
- Define the competition regulations, such as individual awards and school awards
- Display a clear analysis report

Candidates should be aware of the reusability of the program design and justify the use of any data structures and algorithms in the implementation.

7. Computer Assisted Learning (CAL)

A secondary school would like to design an educational software to assist students' learning. Suppose you are the IT project manager responsible for the project. You are going to provide solutions for the school.

You are required to

- Select one or more topics of any subject in secondary school syllabus.
- Develop an educational software program that consists of a series of lessons, quizzes, educational games, etc.

You should justify the use of any data structures and algorithms in the implementation.

8. CIT 2010: Phone book directory

Candidates are required to implement a phone book directory program to store names, telephone numbers, email addresses as well as other useful personal information. The program should allow entries to be listed in different ways.

Candidates should also develop a search engine which locates particular entries by inputting different search criteria.

Candidates should demonstrate that they are aware of the reusability of the program design and justify the use of any data structures and algorithms in the implementation.

Items to be submitted:

- A report (word document) with the following chapters:
 - Chapter 1: Introduction
 - Chapter 2: Design **(10)**
 - Chapter 3: Implementation **(15)**
 - Chapter 4: Testing & Evaluation **(15)**
 - Chapter 5: Reference & Acknowledgement
 - Appendices:
 - Program Code
 - Working schedule
- The source code of the Pascal program (.pas), the executable file (.exe), the data files, the report files, etc.

Working Schedule:

Date	Task to be done
May-2018	Choice of Topic, Background research + Define the objectives + Propose Functions
July-2018	Design of Solution
Oct-2018	Implementation
Nov-2018	Testing & Evaluation
Dec-2018	Final Report

Assessment Criteria:**1. Task 1 (Design & Implementation)**

Describing the design of the solution for the selected problem. Demonstrating results and providing evidence of the implementation process.

Performance	Description
High (17 – 25 Marks)	<ul style="list-style-type: none"> • Creates an innovative design for the solution • Demonstrates effective ICT skills in the appropriate use of resources • Demonstrates appropriate ICT skills coherently • Demonstrates effective and comprehensive data/information collection, capture and input • Demonstrates effective and comprehensive data/information verification and validation • Demonstrates effective, efficient and comprehensive data/information processing • Creates an appropriate output format of the deliverables that can easily be tested as a solution to the problem
Middle (9 – 16 Marks)	<ul style="list-style-type: none"> • Provides some new ideas in designing the solution • Demonstrates ICT skills in the use of resources with understanding • Demonstrates appropriate ICT skills adequately • Demonstrates reasonable data/information collection, capture and input • Demonstrates reasonable data/information verification and validation • Demonstrates reasonably good quality of data/information processing • Creates an output format of the deliverables that can be tested as a solution to the problem
Low (0 – 8 Marks)	<ul style="list-style-type: none"> • Produces a plain design of the solution • Uses resources with relevant ICT skills • Demonstrates appropriate ICT skills occasionally • Demonstrates an awareness of the necessary data/information collection, capture and input • Demonstrates an awareness of the necessary data/information verification and validation • Carries out data/information processing relevant to the problem • Creates an output format of the deliverables that can be partially tested as a solution to the problem

2. Task 2 (Testing & Evaluation)

Testing and evaluating the deliverables.

Performance	Description
High (11 – 15 Marks)	<ul style="list-style-type: none">• Records test results comprehensively according to the testing plan with quality metrics• Demonstrates a comprehensive methodology in testing and evaluation• Suggests and explain improvement made as a result of testing• Conducts corrective/preventive actions logically• Evaluates the effectiveness of the deliverables relative to the environmental factors• Presents the findings using a systematic style and appropriate terminology• Organises and present the objectives and original thought effectively• Reflect the student's learning process effectively
Middle (6 – 10 Marks)	<ul style="list-style-type: none">• Records test results generally according to the testing plan• Demonstrates a general methodology in testing and evaluation• Suggests some practical improvement• Conducts some corrective/preventive actions appropriately• Evaluates the effectiveness of the deliverables relative to the partial environmental factors• Presents the findings with a comprehensible and sensible style• Expresses ideas and visions successfully• Reflects the student's learning process
Low (0 – 5 Marks)	<ul style="list-style-type: none">• Records some test results• Demonstrates a basic methodology in testing and evaluation• Attempts to improve the deliverables• Attempts to evaluate the effectiveness of the deliverables• Presents the findings with text and illustration

Reference: http://www.hkeaa.edu.hk/en/sba/sub_info_sba/dse_subject.html?16&5

評核準則

1. 課業一「構思與應用」

說明解決問題的構思。展示應用上述構思的過程中所得的結果並提供佐證。

表現	說明
高 (17–25 分)	<ul style="list-style-type: none"> 解決方法的構思具創意 以資訊及通訊科技技能有效及妥當地運用資源 貫徹地展示恰當的資訊及通訊科技技能 能扼要而全面地提供有關收集、記錄和輸入數據／資訊 能透過精簡且必要的程序對數據／資訊進行驗證及有效性檢驗 數據／資訊處理清晰、有用而奏效 交付成果所用的輸出格式能妥善地解決問題
中 (9–16 分)	<ul style="list-style-type: none"> 能在構思解決方法上提出新意念 以資訊及通訊科技技能運用資源，並明白背後的道理 適當地展示恰當的資訊及通訊科技技能 能扼要地提供有關收集、記錄和輸入數據／資訊 能透過合理的程序對數據／資訊進行驗證及有效性檢驗 數據／資訊處理完備 交付成果所用的輸出格式能解決問題
低 (0–8 分)	<ul style="list-style-type: none"> 所構思的方法中規中矩 以相關的資訊及通訊科技技能運用資源 偶爾展示恰當的資訊及通訊科技技能 能提供有關收集、記錄和輸入數據／資訊 能透過一些程序對數據／資訊進行驗證及有效性檢驗 執行一些有關數據／資訊處理 交付成果所用的輸出格式能解決局部問題

2. 課業二「測試與評估」

對交付成果進行測試與評估。

表現	說明
高 (11–15 分)	<ul style="list-style-type: none"> 能按照測試計畫內的測量指標概括地記錄測試結果 能用周全的方法來進行測試及評估 根據測試結果提出改善建議，並加以解釋 邏輯地運用糾正／預防措施 對照環境因素評估交付成果的效用 利用恰當的詞彙有系統地展示結果 能有條不紊地闡述目的和創見 能充分反映學生的學習過程
中 (6–10 分)	<ul style="list-style-type: none"> 能按照測試計畫記錄一般測試結果 能用一般的方法來進行測試及評估 能提出一些實用的改善建議 適當地運用糾正／預防措施 對照部分環境因素評估交付成果的效用 展示的結果齊全及言之有物 能清楚地表達了概念和想法 能反映學生的學習過程
低 (0–5 分)	<ul style="list-style-type: none"> 記錄了一些測試結果 能用基本的方法來進行測試及評估 嘗試改善交付成果 嘗試評估交付成果的效用 展示的結果尚算圖文並茂

Reference: http://www.hkeaa.edu.hk/tc/sba/sub_info_sba/dse_subject.html?16&5