AQA

A-level
COMPUTER SCIENCE

Paper 1

June 2022

Preliminary Material

To be opened and issued to candidates on or after 1 September 2021, subject to the instructions given in the Teachers' Notes (7517/1/TN).

Note

- The Preliminary Material and Skeleton Program are to be seen by candidates and their teachers **only**, for use during preparation for the June 2022 examination. They **cannot** be used by anyone else for any other purpose, other than that stated in the instructions issued, until after the examination date has passed. They must **not** be provided to third parties.

Information

- A Skeleton Program is provided separately by your teacher and must be read in conjunction with this Preliminary Material.

- You are advised to familiarise yourselves with the Preliminary Material and Skeleton Program before the examination.

- A copy of this Preliminary Material and the Skeleton Program will be made available to you in hard copy and electronically at the start of the examination.

- You must **not** take any copy of the Preliminary Material, Skeleton Program or any other material into the examination room.

7517/1/PM

There is no Preliminary Material printed on this page

INSTRUCTIONS FOR CANDIDATES

Electronic Answer Document

Answers for all questions, in all sections, must be entered into the word-processed document made available to you at the start of the examination and referred to in the question paper rubrics as the **Electronic Answer Document**.

Preparation for the Examination

You should ensure that you are familiar with the **Preliminary Material** and the **Skeleton Program** for your programming language.

Data Files

Data Files named **locks.txt** and **game1.txt** are supplied with the **Skeleton Program**.

Turn over ▶

Breakthrough!

Breakthrough! is a one-player card game in which the player attempts to open a series of locks using tools represented by cards.

There are three toolkits available to the player: the acute kit (represented by the letter a), the basic kit (represented by the letter b) and the crude kit (represented by the letter c).

There are three different types of tool: picks, files and keys. Each toolkit contains five picks, three files and three keys. A pick is represented by the letter P, a file is represented by the letter F and a key is represented by the letter K.

Each lock consists of a set of challenges. The number of challenges varies from lock to lock. To open a lock, the player will need to solve all of the lock's challenges by using particular tools from their toolkits in a specified order. The order that the player solves the challenges in does not matter.

The player starts the game with five cards in their hand. On each turn, they either discard a card from their hand or play a card from their hand to the lock sequence. If a series of cards in the lock sequence matches a challenge on the lock they are currently trying to open, then that challenge has been met. Once all the challenges for a lock have been met, the lock is opened and the player is given another randomly selected lock to attempt to open. Any cards that were discarded are then shuffled back into the deck of cards, but cards that were played to the lock sequence stay there and are no longer available for the player to use.

The player cannot play a card from their hand to the lock sequence if that card represents the same type of tool as the card most recently added to the lock sequence.

A player will always have five cards in their hand.

On each turn, the card the player chooses to use from their hand is replaced by the top card from the deck. If the card at the top of the deck is a difficulty card, then it is not added to the player's hand and, instead, the player has to choose to discard a key from their hand (if they have a key) or to discard the top five cards from the deck. A difficulty card represents an unexpected event happening that has made opening the lock more difficult, eg a mistake made when using one of the tools.

After a player has resolved a difficulty card, their hand is filled with cards from the deck so that they have five cards again. When doing this, any difficulty cards drawn from the deck are discarded instead of being put in the player's hand.

The game ends when the deck becomes empty and it is not possible to fill the player's hand with five cards.

The aim of the game is to get as high a score as possible. A player's score is increased by playing cards to the lock sequence, completing challenges on a lock and opening locks.

Figure 1 shows an example of a lock consisting of two challenges. Both of these challenges need to be solved for the lock to be opened. To solve the first challenge, the player needs to use a pick from toolkit `a`, then a file from toolkit `a` and then another pick from toolkit `a`. To solve the second challenge, they need to use a key from toolkit `b`.

Figure 1

```
P a, F a, P a
K b
```

Figure 2 shows the start of an example game where the player is trying to open the lock shown in **Figure 1**. The card drawn at the end of each turn and added to the hand is shown in bold.

Figure 2

Hand:
 ```-----------------------------```
 `| K a | P a | P c | F a | P c |`
 ```-----------------------------```
 	
 Discard: empty
 	
 Sequence: empty
	At the start of the game the discard pile and the sequence are both empty.
	
	 The player's hand starts with five randomly selected tool cards.

Hand:
 ```-----------------------------```
 `| K a | P c | F a | P c |` **`K b`** `|`
 ```-----------------------------```
 	
 Discard: empty
 	
 Sequence: ```-------```
 `| P a |`
 ```-------```
	On their first turn, the player chooses to use their second card, a pick from toolkit `a`, and plays it.
	
	 The new card drawn from the deck is a key from toolkit `b`.

Hand:
 ```-----------------------------```
 `| K a | P c | P c | K b |` **`F c`** `|`
 ```-----------------------------```
 	
 Discard: empty
 	
 Sequence: ```-------------```
 `| P a | F a |`
 ```-------------```
	On their second turn, the player plays a file from toolkit `a` to the sequence.
	
	 The new card drawn from the deck is a file from toolkit `c`.

Turn over ►

```
              ---------------------------------
Hand:         | K  a | P  c | K  b | F  c | P  a |
              ---------------------------------
              -------
Discard:      | P  c |
              -------
              -------------
Sequence:     | P  a | F  a |
              -------------
```

The player is close to completing one of the challenges on the lock (the first challenge) but does not have the final card they need in their hand (a pick from toolkit a).

If they were to play one of the cards from their current hand to the sequence, there would no longer be the potential to solve the first challenge by playing a pick from toolkit a to the sequence. So they choose to discard a card rather than play a card to the sequence.

The new card drawn from the deck is a pick from toolkit a.

```
                ---------------------------------
Hand:           | K  a | P  c | K  b | F  c | F  b |
                ---------------------------------
                -------
Discard:        | P  c |
                -------
                -------------------
Sequence:       | P  a | F  a | P  a |
                -------------------
```

On their fourth turn, the player plays the pick from toolkit a to the sequence.

This completes one of the challenges for the current lock.

The new card drawn from the deck is a file from toolkit b.

```
                ---------------------------------
Hand:           | K  a | P  c | F  c | F  b | P  a |
                ---------------------------------

Discard:        empty

                -------------------------
Sequence:       | P  a | F  a | P  a | K  b |
                -------------------------

New lock:       K  a
                K  b
                K  c
```

The player then plays a key from toolkit b to the sequence.

This completes the second challenge for the lock and the lock has now been successfully opened.

The new card drawn from the deck is a pick from toolkit a. The discard pile has been shuffled back into the deck.

The player is given a new lock to try to open. This new lock has three challenges to complete.

```
                -----------------------------
Hand:          | K a | F c | F b | P a | K c |
                -----------------------------

Discard:  empty

                -----------------------------
Sequence:      | P a | F a | P a | K b | P c |
                -----------------------------
```

The player would like to play their key from toolkit `a` to the sequence but they can't do this as the most recent card in the sequence is a key.

They play a pick from toolkit `c` to the sequence.

The new card drawn from the deck is a key from toolkit `c`.

```
                -----------------------------
Hand:          | F c | F b | P a | K b | P b |
                -----------------------------
                ---------------------
Discard:       | Dif | K c | Dif |
                ---------------------

                -----------------------------
Sequence:      | P a | F a | P a | K b | P c |
                -----------------------------
               | K a |
                -------
```

They now play the key from toolkit `a` to the sequence, completing one of the challenges for the current lock.

The new card drawn from the deck is a difficulty card. The player could choose to discard the key from toolkit `c` from their hand or to discard five cards from the deck. They do need a key from toolkit `c` to open this lock but if they choose to discard five cards, they come closer to losing the game and might end up discarding more cards than they need.

They choose to discard the key from toolkit `c`. The difficulty card is also put in the discard pile.

The cards drawn from the deck are a key from toolkit `b` and another difficulty card. The difficulty card goes to the discard pile and is replaced by the top card from the deck, which is a pick from toolkit `b`.

The program allows the player to start a new game or to load a partially played game stored in a text file.

END OF PRELIMINARY MATERIAL

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