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Cambridge International Advanced Subsidiary and Advanced Level

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**COMPUTER SCIENCE**

**9608/33**

Paper 3 Written Paper

**May/June 2017**

MARK SCHEME

Maximum Mark: 75

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**Published**

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This document consists of **7** printed pages.

| Question  | Answer                                                                                                                                                                                                                                                                   | Marks       |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 1(a)(i)   | DECLARE Book : LibraryBookRecord                                                                                                                                                                                                                                         | 1           |
| 1(a)(ii)  | Book.Title ← "Dune"                                                                                                                                                                                                                                                      | 1           |
| 1(b)      | TYPE LibraryBookRecord<br>DECLARE ISBN : INTEGER<br>DECLARE Title : STRING<br>DECLARE Genre : (Fiction, Non-Fiction)<br>DECLARE NumberOfLoans : 1 .. 99<br>ENDTYPE<br>mark for correct declaration and first two fields ( <b>note</b> : only if attempt at modification) | 1<br>1<br>1 |
| 1(c)(i)   | 6715                                                                                                                                                                                                                                                                     | 1           |
| 1(c)(ii)  | 8216                                                                                                                                                                                                                                                                     | 1           |
| 1(c)(iii) | 88                                                                                                                                                                                                                                                                       | 1           |
| 1(c)(iv)  | FALSE                                                                                                                                                                                                                                                                    | 1           |
| 1(d)(i)   | Temp2 ← 22                                                                                                                                                                                                                                                               | 1           |
| 1(d)(ii)  | IntPtr ← @Temp1                                                                                                                                                                                                                                                          | 1           |
| 1(d)(iii) | IntPtr^ ← Temp2                                                                                                                                                                                                                                                          | 1           |

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| Question  | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Marks                                                                     |               |           |               |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------|-----------|---------------|-----------|-----------|----------|----------|---|---|---|---|----------|---|---|---|---|---|--|---|---|---|---|--|---|---|---|---|--|---|---|---|---|--|---|---|---|---|--|---|---|---|---|--|---|---|
| 3(a)      | $X = A.(\bar{B} + (B \cdot C))$<br>$B.C$<br>$\bar{B} + B.C$<br>$A.$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3<br>1<br>1<br>1                                                          |               |           |               |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| 3(b)      | <table><tr><th>A</th><th>B</th><th>C</th><th>Working Space</th><th>X</th></tr><tr><td>0</td><td>0</td><td>0</td><td></td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td></td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td><td></td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td></td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td></td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td><td></td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td></td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td><td></td><td>1</td></tr></table> <p>1 mark first four entries, 1 mark for the last four entries</p> | A                                                                         | B             | C         | Working Space | X         | 0         | 0        | 0        |   | 0 | 0 | 0 | 1        |   | 0 | 0 | 1 | 0 |  | 0 | 0 | 1 | 1 |  | 0 | 1 | 0 | 0 |  | 1 | 1 | 0 | 1 |  | 1 | 1 | 1 | 0 |  | 0 | 1 | 1 | 1 |  | 1 | 2 |
| A         | B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | C                                                                         | Working Space | X         |               |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| 0         | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0                                                                         |               | 0         |               |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| 0         | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1                                                                         |               | 0         |               |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| 0         | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0                                                                         |               | 0         |               |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| 0         | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1                                                                         |               | 0         |               |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| 1         | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0                                                                         |               | 1         |               |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| 1         | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1                                                                         |               | 1         |               |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| 1         | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0                                                                         |               | 0         |               |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| 1         | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1                                                                         |               | 1         |               |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| 3(c)(i)   | <p style="text-align: center;"><b>AB</b></p> <table><tr><td></td><td></td><td><b>00</b></td><td><b>01</b></td><td><b>11</b></td><td><b>10</b></td></tr><tr><td rowspan="2"><b>C</b></td><td><b>0</b></td><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td><b>1</b></td><td>0</td><td>0</td><td>1</td><td>1</td></tr></table>                                                                                                                                                                                                                                                                                                          |                                                                           |               | <b>00</b> | <b>01</b>     | <b>11</b> | <b>10</b> | <b>C</b> | <b>0</b> | 0 | 0 | 0 | 1 | <b>1</b> | 0 | 0 | 1 | 1 | 1 |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>00</b>                                                                 | <b>01</b>     | <b>11</b> | <b>10</b>     |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| <b>C</b>  | <b>0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                                                                         | 0             | 0         | 1             |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
|           | <b>1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                                                                         | 0             | 1         | 1             |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| 3(c)(ii)  | <p style="text-align: center;"><b>AB</b></p> <table><tr><td></td><td></td><td><b>00</b></td><td><b>01</b></td><td><b>11</b></td><td><b>10</b></td></tr><tr><td rowspan="2"><b>C</b></td><td><b>0</b></td><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td><b>1</b></td><td>0</td><td>0</td><td>1</td><td>1</td></tr></table>                                                                                                                                                                                                                                                                                                          |                                                                           |               | <b>00</b> | <b>01</b>     | <b>11</b> | <b>10</b> | <b>C</b> | <b>0</b> | 0 | 0 | 0 | 1 | <b>1</b> | 0 | 0 | 1 | 1 | 2 |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>00</b>                                                                 | <b>01</b>     | <b>11</b> | <b>10</b>     |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| <b>C</b>  | <b>0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                                                                         | 0             | 0         | 1             |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
|           | <b>1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                                                                         | 0             | 1         | 1             |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| 3(c)(iii) | $X = A.\bar{B} + A.C$<br><br>1      1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2                                                                         |               |           |               |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |
| 3(d)      | $X = A.(\bar{B} + (B \cdot C))$<br>$X = A.(\bar{B} + C)$<br>$X = A.\bar{B} + A.C$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2<br>1<br>1 (dependent mark – must be correct outcome from previous line) |               |           |               |           |           |          |          |   |   |   |   |          |   |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |   |   |  |   |   |

| Question   | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Marks       |           |        |      |        |   |        |       |        |      |   |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------|--------|------|--------|---|--------|-------|--------|------|---|
| 4(a)       | Example:<br>Speed of access<br>Just used as a look-up file<br>No need for any serial or sequential processing<br>1 mark for any valid point                                                                                                                                                                                                                                                                                                                                                                                                       | 1           |           |        |      |        |   |        |       |        |      |   |
| 4(b)(i)    | <table><tr><td>CustomerID</td><td>RecordKey</td></tr><tr><td>802139</td><td>2139</td></tr><tr><td>700004</td><td>4</td></tr><tr><td>689998</td><td>89998</td></tr><tr><td>102139</td><td>2139</td></tr></table>                                                                                                                                                                                                                                                                                                                                   | CustomerID  | RecordKey | 802139 | 2139 | 700004 | 4 | 689998 | 89998 | 102139 | 2139 | 1 |
| CustomerID | RecordKey                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             |           |        |      |        |   |        |       |        |      |   |
| 802139     | 2139                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |           |        |      |        |   |        |       |        |      |   |
| 700004     | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |           |        |      |        |   |        |       |        |      |   |
| 689998     | 89998                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |           |        |      |        |   |        |       |        |      |   |
| 102139     | 2139                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |           |        |      |        |   |        |       |        |      |   |
| 4(b)(ii)   | Minimum value: 0<br>Maximum value: 99999                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1<br>1<br>2 |           |        |      |        |   |        |       |        |      |   |
| 4(b)(iii)  | <pre>PROCEDURE InsertRecord(CustomerID : INTEGER)   RecordKey ← CustomerID MOD 100000   Success ← FALSE   // Find position for new record and insert it   REPEAT     IF record at position RecordKey is <u>empty</u>       THEN         Insert new record at position RecordKey         Success ← TRUE       ELSE         IF RecordKey = <u>99999</u>           THEN             RecordKey ← <u>0</u>           ELSE             RecordKey ← <u>RecordKey</u> + 1           ENDIF         ENDIF       UNTIL Success = TRUE     ENDPROCEDURE</pre> | 4           |           |        |      |        |   |        |       |        |      |   |
| 4(c)(i)    | For security<br>If file is hacked then encrypted PIN cannot be used<br>Only encrypted PINs are transmitted and compared<br>1 mark for any valid point                                                                                                                                                                                                                                                                                                                                                                                             | Max 2       |           |        |      |        |   |        |       |        |      |   |
| 4(c)(ii)   | <pre>1. Customer ID is read from card 2. Customer enters PIN 3. Customer PIN is <u>encrypted</u> 4. <u>Customer ID is hashed</u> 5. Customer record is located in file 6. <u>PIN is checked against PIN in record</u> 7. If match then transaction can proceed</pre>                                                                                                                                                                                                                                                                              | 3           |           |        |      |        |   |        |       |        |      |   |

| Question  | Answer                                                                                                                                                                                                                                                                                                      | Marks                       |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 5(a)(i)   | Packet:<br>Both web page and web page request are split into packets<br>Each packet is sent individually from device to device                                                                                                                                                                              | <b>2</b><br>1<br>1          |
| 5(a)(ii)  | Router:<br>Transmit packets<br>Contain connections to many other routers<br>When packets arrive at router, router decides where next to send packet<br>1 mark for any valid point                                                                                                                           | <b>Max 2</b>                |
| 5(a)(iii) | TCP/IP:<br>Is the protocol<br>Rules for communication between web server and browser                                                                                                                                                                                                                        | <b>2</b><br>1<br>1          |
| 5(b)(i)   | <b>Two</b> from:<br>Picture and sound not synchronised<br>Interruptions // video not continuous<br>Can be degraded by other competing traffic                                                                                                                                                               | <b>Max 2</b><br>1<br>1<br>1 |
| 5(b)(ii)  | <u>Dedicated</u> communications channel between the two communicating devices<br>Established prior to start of communication // removal of links at end of communication                                                                                                                                    | <b>2</b><br>1<br>1          |
| 5(b)(iii) | In packet switching, packets can take different routes and may not arrive in order<br>Will arrive in order (only one route)<br>As packets can take many different routes / share paths with others can be delayed<br>Dedicated circuit has full bandwidth<br>No loss of synch<br>1 mark for any valid point | <b>Max 3</b>                |

| Question  | Answer                                                                                                                         | Marks              |
|-----------|--------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 6(a)(i)   | Control system                                                                                                                 | <b>1</b>           |
| 6(a)(ii)  | Use of actuators means that the system is controlling                                                                          | <b>1</b>           |
| 6(b)      | System wastes processor time checking for values that are not changing<br>Some sensor input needs to be acted upon immediately | 1<br>1<br><b>2</b> |
| 6(c)(i)   | Interrupts need to be disabled so that the process of dealing with an interrupt is itself not interrupted                      | <b>1</b>           |
| 6(c)(ii)  | After handling the interrupt interrupts need to be enabled so that further interrupts can be dealt with                        | <b>1</b>           |
| 6(c)(iii) | Content of <u>registers</u><br>Placed on stack                                                                                 | 1<br>1<br><b>2</b> |
| 6(c)(iv)  | Changing sensor value dealt with as soon as it happens<br>Processor needs to check sensor only when an <u>interrupt occurs</u> | 1<br>1<br><b>2</b> |
| 6(c)(v)   | AND #B00000001000000000 // AND #&0200 // AND #512<br>Op code<br>Operand                                                        | 1<br>1<br><b>2</b> |