MARK SCHEME for the October/November 2015 series

0478 COMPUTER SCIENCE

0478/13   Paper 1, maximum raw mark 75

1 (a) Temperature
  – central heating / air con system
  – greenhouse environment
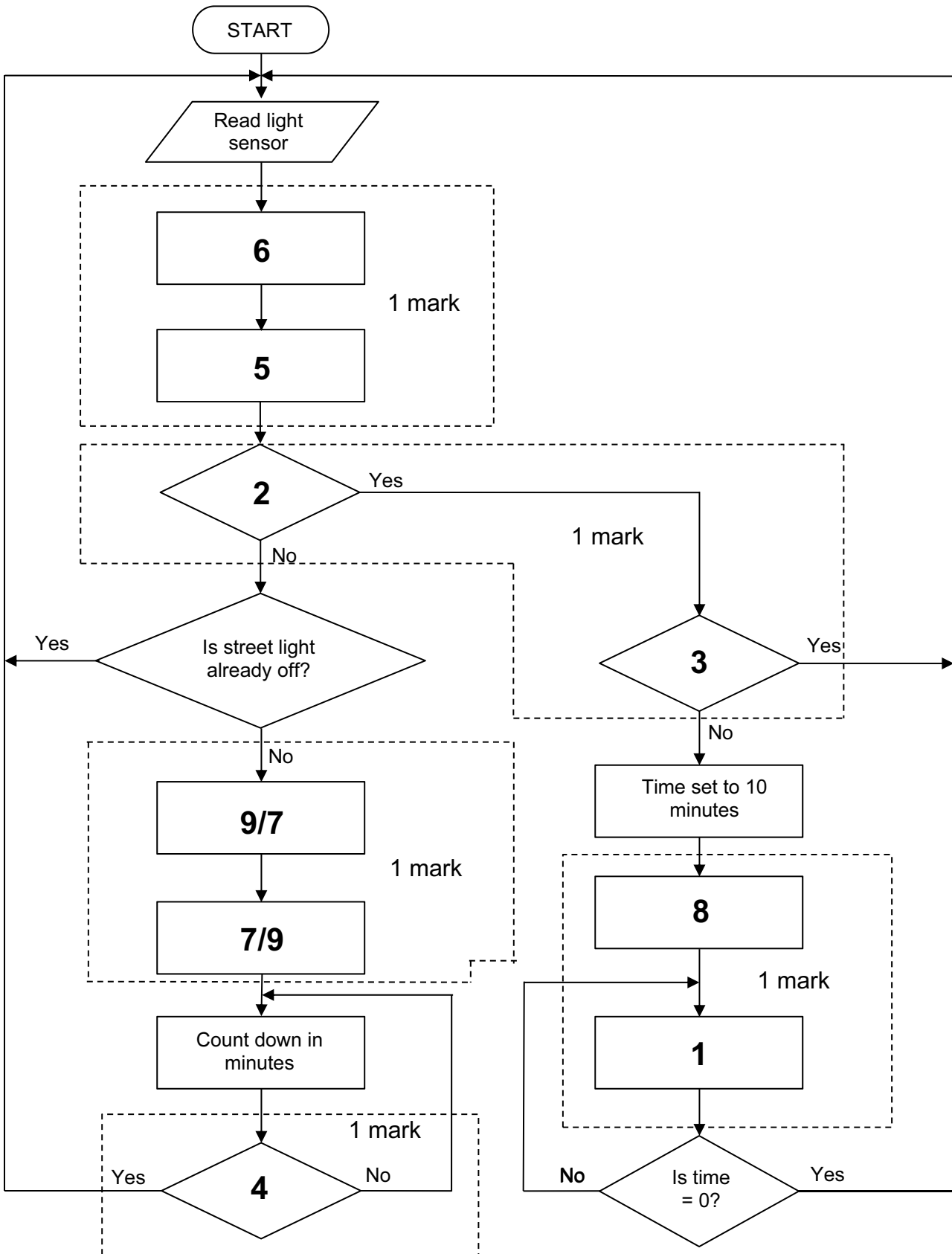 – a chemical reaction / process

  Magnetic field
  – anti-lock brakes on a car
  – detection of motor vehicles (e.g. at traffic lights)
  – reading magnetic ink characters on cheques
  – geophysical surveys

  Motion
  – automatic doors
  – burglar alarm   [3]

(b)

```
                    ┌─────────────┐
                    │    START    │
                    └──────┬──────┘
                           ▼
                  ╱─────────────────╱
                 ╱   Read light    ╱
                ╱     sensor      ╱
               ╱─────────────────╱
                           │
          ┌────────────────┼──────────────────┐
          │                ▼                   │
          │        ┌───────────────┐           │
          │        │       6       │           │   1 mark
          │        └───────┬───────┘           │
          │                ▼                   │
          │        ┌───────────────┐           │
          │        │       5       │           │
          │        └───────┬───────┘           │
          └────────────────┼──────────────────┘
                           ▼
     ┌─────────────────────────────────────────────────────┐
     │            ╱╲                    Yes                 │
     │           ╱  ╲                                       │
     │          ╱ 2  ╲──────────────────────┐    1 mark     │
     │           ╲    ╱                      │               │
     │            ╲  ╱                       │               │
     └─────────────╲╱───────────────────────│───────────────┘
                    │ No                     │
                    ▼                        ▼
   Yes      ╱────────────────╲         ╱──────────╲   Yes
  ◄─────────   Is street light         ╱    3     ╲────────►
            ╲  already off?  ╱          ╲          ╱
             ╲──────────────╱            ╲────────╱
                    │ No                      │ No
     ┌──────────────┼────────────┐            ▼
     │              ▼            │     ┌───────────────┐
     │      ┌───────────────┐    │     │ Time set to 10│
     │      │     9/7       │    │     │   minutes     │
     │      └───────┬───────┘    │1 mark└───────┬───────┘
     │              ▼            │   ┌──────────┼──────────┐
     │      ┌───────────────┐    │   │          ▼          │
     │      │     7/9       │    │   │  ┌───────────────┐  │
     │      └───────┬───────┘    │   │  │       8       │  │
     └──────────────┼────────────┘   │  └───────┬───────┘  │ 1 mark
                    ▼                 │          ▼          │
            ┌───────────────┐         │  ┌───────────────┐  │
            │  Count down in │        │  │       1       │  │
            │    minutes     │        │  └───────┬───────┘  │
            └───────┬───────┘         └──────────┼──────────┘
      ┌─────────────┼──────────┐                 ▼
      │      1 mark │          │    No    ╱──────────────╲  Yes
  Yes │       ╱╲    ▼          │  ◄───────   Is time       ────►
  ◄───│──────╱  ╲   No         │           ╲   = 0?      ╱
      │     ╱ 4  ╲─────►       │            ╲────────────╱
      │      ╲    ╱            │
      │       ╲  ╱             │
      └────────╲╱──────────────┘
```

[5]

2 **(a)** Any **five** from:
- sensors send signals / data to microprocessor
- signal / data <u>converted to digital</u> (by an ADC)
- microprocessor compares temperature / carbon monoxide level / value with stored level / value
- if CO level > stored value, microprocessor sends signal…
- if temperature > stored value, microprocessor sends signal…
- …to light warning bulb on dashboard / sounds alarm   [5]

(b) (i) **2 marks for all correct conditions, 1 mark for 2 correct conditions**

CO (carbon monoxide) level too high
oil pressure too low
brake pads too thin   [2]

(ii) 1 mark for each correct parity bit in position 1

1	1	1	1	0	0	1	0

0	0	0	0	1	1	1	0

[2]

(iii) 1 mark for correct parity bit + 1 mark for remainder of binary value

1	0	1	0	0	0	1	0

[2]

(iv) A 2 (allow follow through from part (iii))   [1]

3 **(a) (i)**

MAR

1	0	0	0	0	0	0	1

MDR

0	1	0	1	0	0	0	1

[2]

(ii)

MAR

1	0	0	0	1	1	1	0

MDR

0	1	1	1	1	0	0	1

[2]

(iii)

Address	Contents
1000 0000	0110 1110
1000 0001	0101 0001
1000 0010	1000 1101
1000 0011	1000 1100
1000 1100	
1000 1101	
1000 1110	**0111 1001**
1000 1111	

[1]

(b) – CIR (Current Instruction Register)
– PC (Program Counter)
– Acc (Accumulator) [3]

(c) – Controls operation of memory, processor and input / output
– <u>Instructions</u> are interpreted
– Sends signals to other components telling them "what to do" [3]

4 (a) (i) Free software / open source software [1]

(ii) Any **three** from:
– Set of principles / laws that regulate the use of computers
– Covers intellectual property rights (e.g. copying of software)
– Privacy issues (e.g. accessing personal information)
– Impact of computers on society (relevant examples can be credited) [3]

(b) 1 mark for each CORRECT row

Statement	Firewall	Proxy server
Speeds up access of information from a web server by using a cache		✓
Filters all Internet traffic coming into and out from a user's computer, intranet or private network	✓	✓
Helps to prevent malware, including viruses, from entering a user's computer	✓	
Keeps a list of undesirable websites and IP addresses	✓	✓

[4]

(c) **one** mark for method + **one** mark for linked reason (maximum 6 marks)

– back up files…
– …on a regular basis / to another device / to the cloud

– set data to read only…
– …to prevent accidental editing

– save data on a regular basis…
– …to prevent loss / corruption of data in unexpected shutdown / failure

– use correct shut down / start up procedures…
– …to prevent damage to components / stored files

– use correct procedures before disconnecting portable storage device…
– …to prevent damage to device / data corruption

– keep storage devices in a safe place…
– …away from fire hazards [6]

5 **(a)** – Memory card / SSD / HDD / magnetic tape
– Suitable description of device given [2]

(b) 2 hours = 120 minutes
$120 \times 180 = 21\,600$
$21\,600 / 1024$ (or $21\,600 / 1000$)
= **21.1 GB (or 21.6 GB)**

(1 mark for correct answer and 1 mark for correct calculation) [2]

6 Any **two** from:
– facial recognition software / biometric software used to scan face
– face image converted to digital format / data by the camera
– digital image formed from scanned photo / biometric data stored in passport
– key features of the face are checked / compared [2]

7

Application	Suitable output device
Production of one-off photographs of very good quality	**inkjet printer**
High volume colour printing of advertising flyers	**laser printer**
Production of an object, which is built up layer by layer; used in CAD applications	**3D printer**
Converting electrical signals into sound	**speaker/headphones**
Showing enlarged computer output on a wall or large screen	**Projector**

[5]

8 1 mark for each named application + 1 mark for each matching reason for choice

Input device	Application and reason
Light sensor	Automatic doors – detects a person when light beam broken and opens doors Street lighting – detects change in light and switches on / off the street lights Greenhouse – ensures correct lighting conditions for growth of plants
Keyboard	Word processor / spreadsheet / database – need to key in data manually (e.g. report writing) Control room interface – need to manually key in data (e.g. flow speed of liquid)
Barcode reader	Supermarket checkout – read barcodes to find prices, description – allows automatic stock control Library system – can track books on loan – can link books to borrowers using barcoded cards Airport check-ins – barcodes on luggage to track whereabouts
Touch screen	Ticket / information kiosk – easy method for public to enter data – limited number of options Mobile phone / tablet – easy method to input data – use of icons for application selection Control room interface – faster / easier method to input data into system – fewer chances of error since number of choices limited

[8]

9 (a) 8 MB
100 [2]

(b) (i) Any **two** from:
– removes sounds human ear can't hear very well
– if two sounds played at same time, softer sound removed
– uses perceptual music shaping [2]

(ii) Lossy [1]

(iii) **One** from, for example:
– jpeg
– MP4
– zip
– gif [1]

10 symmetric encryption

encryption key

plain text

encryption algorithm

cypher text [5]