Name:		Index Number:		Class:	

DUNMAN HIGH SCHOOL
Preliminary Examination
Year 6

COMPUTING PAPER 2

9597

Higher 2

100 marks

21 September 2017
3 hours

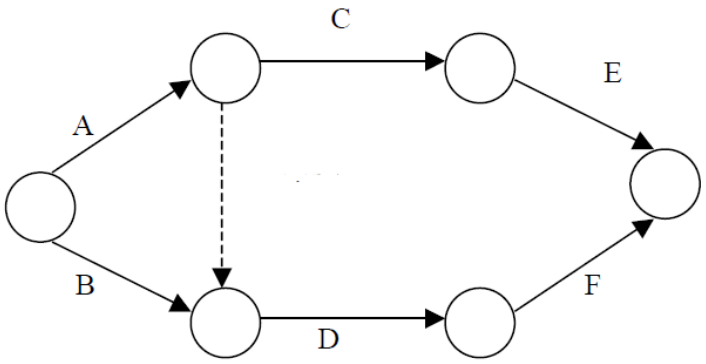
Instructions: Answer all questions.

This paper consists of **6** questions.

[Turn over]

1. Singapore has declared war against diabetes. Health Promotion Board has devised an online Diabetes Risk Assessment (DRA) tool to help users assess if they are at risk of developing Type 2 diabetes.

Fighting against diabetes requires a long-term multi-pronged approach. You have been engaged as a project manager by Unbelievable Company to assemble a project team to help devise preventive programmes for their employees. You have come up with the following PERT chart based on their DRA results for those employees at risk.



Activity	Description	Duration (weeks)
A		2
B		3
C		12
D		12
E		2
F		2

(a) Provide the most appropriate labels (A-F) for the following proposed activities:

- Awareness talk
- Exercise regime
- Healthy cooking workshop
- Healthy eating regime
- Pre-Medical examination
- Post-Medical examination

(b) (i) State the critical path and the minimum project completion time. [2]

(ii) Explain the significance of the dashed line. [2]

(iii) Explain and give an example of a dependent activity. [2]

(iv) Explain and give an example of a concurrent activity. [2]

(c) (i) Create a Gantt chart for the project. [3]

(ii) Explain how the Gantt chart can help the project team carry out its work. [2]

(iii) Give one advantage a PERT chart has over a Gantt chart and one advantage a Gantt chart has over a PERT chart. [2]

(d) The project team would inadvertently have access to some restricted health information submitted by users. Give two ethical considerations related to the privacy of data and possible mitigation measures. [3]

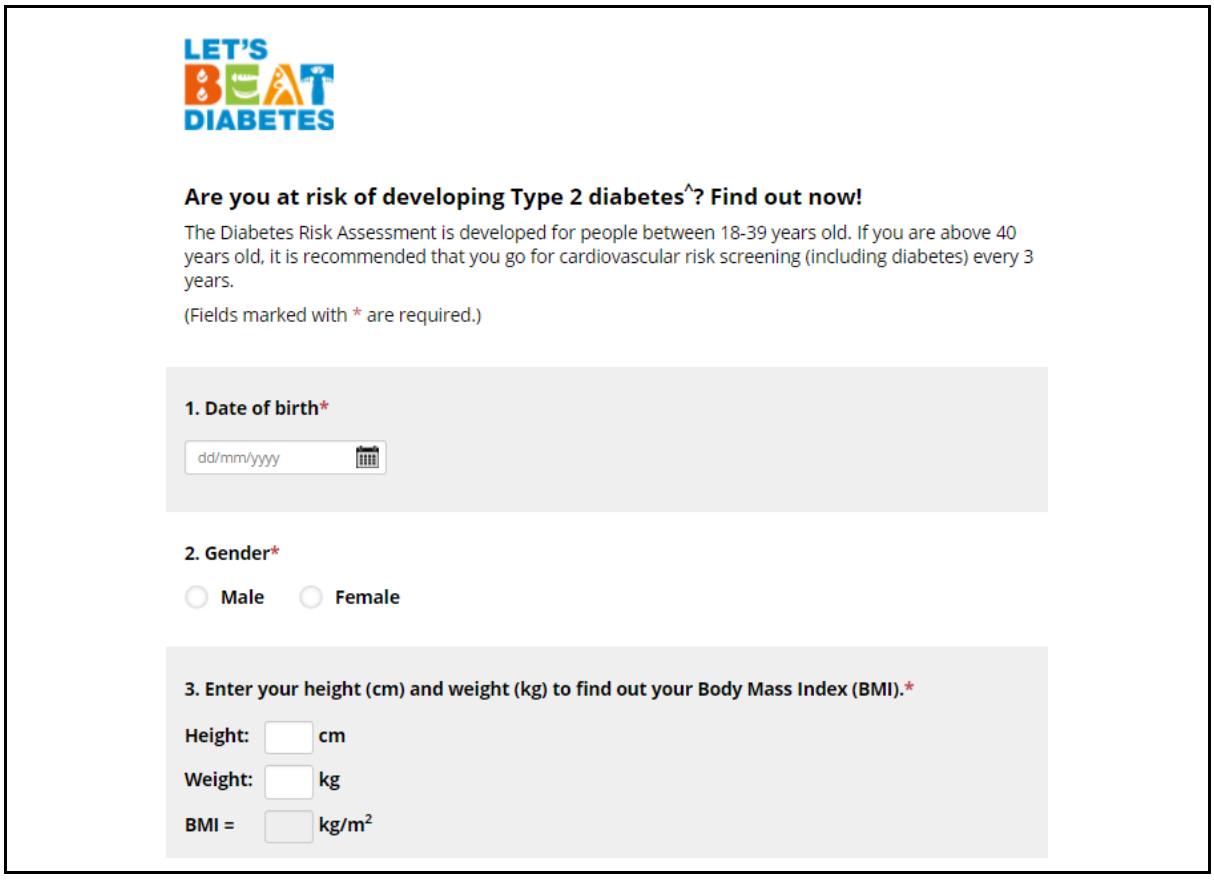
The following diagram shows the screen capture of the DRA form.

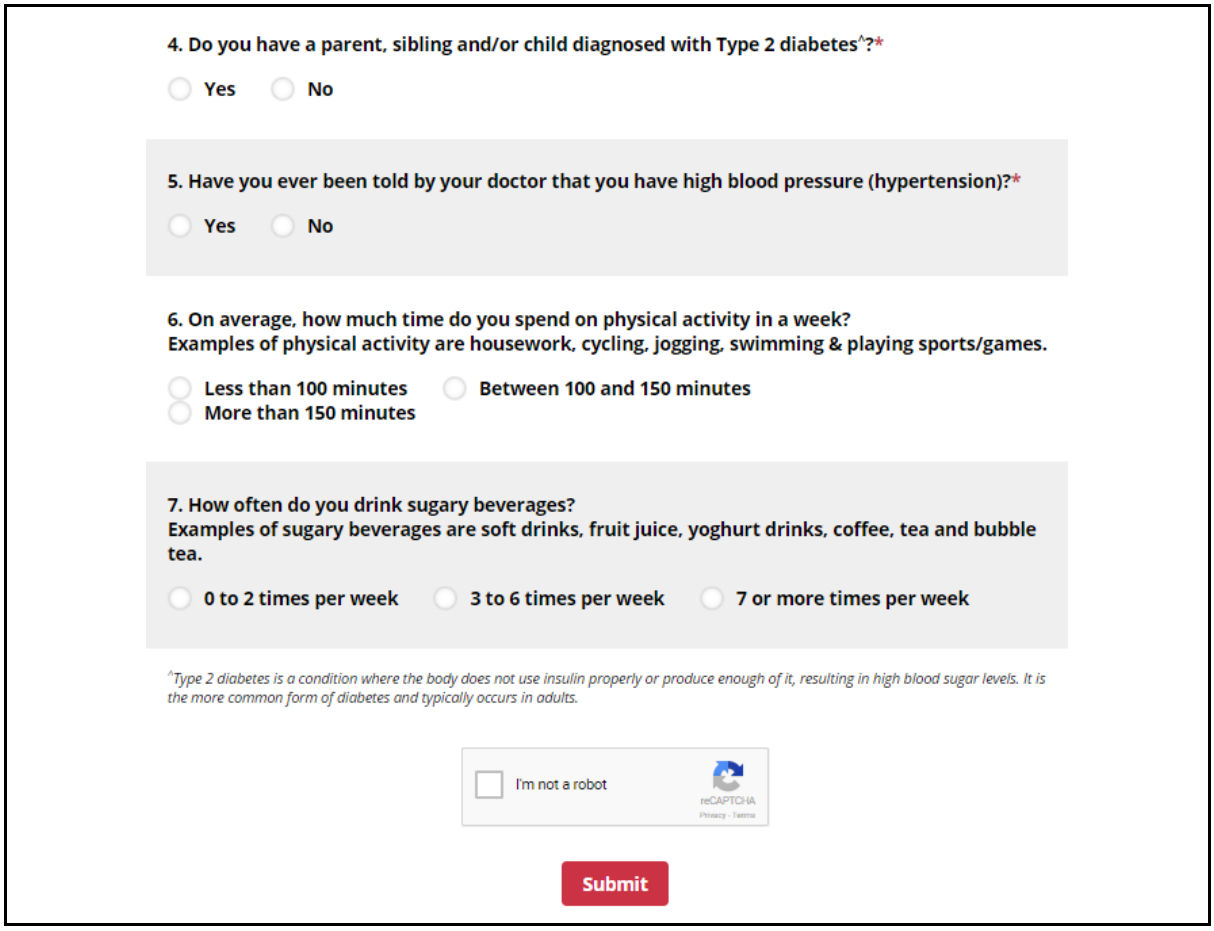
(e) (i) Describe the interface used and justify why this is the most appropriate form of user interaction. [3]

(ii) For question 3 in the DRA, a user enters its height (in cm) and weight (in kg) to compute its Body Mass Index (BMI). What could go wrong and how can such errors be prevented. [4]

(iii) There is a captcha before the submit action button. What is the purpose of the captcha and briefly describe how it works using an appropriate example. [3]

(iv) Discuss how submitted data can be transmitted and stored securely on the server. [2]





(f) You are tasked to setup a wireless network to provide mobile access to the Internet so that users can record and retrieve their real-time fitness data on the go.

(i) Name and describe four major physical components that may be found in a wireless network. [4]

(ii) What is the purpose of SSID? [1]

(g) Given the relationship: bit rate = baud rate * voltage (# bits per signal)

(i) Explain the difference between baud rate and bit rate. [2]

(ii) The following voltage levels expressed in volts are chosen to encode bits:

-6.0, -4.5, -3.0, -1.5, +1.5, +3.0, +4.5, +6.0

How many bits represent these voltages? [1]

(iii) For the above voltages, write down one possible set of corresponding bit patterns. [1]

(iv) If the baud rate of the line is 900 baud what is the bit rate for the voltage levels? [1]

2. You are provided with an array S of non-negative floating point numbers representing the daily starting stock prices of a company over a given day range.

(a) Design a quadratic time complexity $O(n^2)$ algorithm to determine the maximum profit that could have been made by buying and then selling the stock. Explain why your algorithm has this efficiency. [5]

(b) Design a more efficient (either linearithmic O(n lg n) or linear O(n)) algorithm to determine the maximum profit. Explain why your algorithm has this time complexity. [5]

3. You are given 25 distinct integers and a function `Sort5` that can sort 5 integers in one call.

(a) Which sorting function would you use for `Sort5` and why? [3]

(b) Design an algorithm to determine the largest, second largest and third largest integers amongst the 25 integers using the `Sort5` function. Minimise the number of calls to `Sort5`. [7]

4. The following questions relate to a binary search tree (BST) whose keys are the first 16 prime numbers: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53.

(a) Draw the BST given its preorder traversal: 19, 7, 3, 2, 5, 11, 17, 13, 43, 23, 37, 29, 31, 41, 47, 53. [2]

(b) Design an algorithm that takes as input a BST and a value, and returns the first key `k` that would appear in an inorder traversal which is greater than value. What is the efficiency of your algorithm? [4]

(c) Design a more efficient algorithm to determine `k`. What is the efficiency of your improved algorithm? Explain why this algorithm is more efficient. [4]

5. A website hosting company keeps details of its members. Each member has a unique id and name. The company offers two types of membership: Free and Paid. Each free member is able to host a personal static website, while each paid member can host a dynamic website with a database for a monthly fee and is also provided with a helpdesk support email.

The business owner employs a developer to use object-oriented programming to store and process its members' data.

(a) Draw a class diagram showing the relationship between the different memberships. [4]

(b) Using appropriate examples, explain the following terms:

(i) encapsulation

(ii) inheritance

(iii) polymorphism

[6]

(c) The business owner intends to reorganise the membership model. The paid membership will be changed to a Monthly one and a new Annual membership will be introduced. An annual member will pay its fee annually with a 2-month discount, and have access to a dedicated helpdesk support hotline. Explain how this reorganisation will affect your design in **part (a)**. [5]

6. The following figure shows the entry proof of a student for the Singapore-Cambridge GCE A-Level Examination.

2017 SINGAPORE-CAMBRIDGE GCE A-LEVEL EXAMINATION
Entry Proof for School Candidates

Statutory Name : LIM AH SENG
NRIC : S9987654A
Centre / Index No. : 3042 / 1234
Academic Level : JC 2
School Name : RESERVED JUNIOR COLLEGE
Class Name : 23

Subject Code / Paper	Subject Name	Mode of Assessment	School Code	Exam Date	Start Time	Duration
9749 / 04	H2 PHYSICS	SCIENCE PRACTICAL		16-OCT-2017		2 hr 30 min
8807 / 01	H1 GENERAL PAPER	WRITTEN	3101	06-NOV-2017	08:00	1 hr 30 min
8807 / 02	H1 GENERAL PAPER	WRITTEN	3101	06-NOV-2017	10:30	1 hr 30 min
8872 / 02	H1 CHEMISTRY	WRITTEN	3101	07-NOV-2017	08:00	2 hr 0 min
9758 / 01	H2 MATHEMATICS	WRITTEN	3101	09-NOV-2017	08:00	3 hr 0 min
9758 / 02	H2 MATHEMATICS	WRITTEN	3101	13-NOV-2017	08:00	3 hr 0 min
9749 / 02	H2 PHYSICS	WRITTEN	3101	16-NOV-2017	08:00	2 hr 0 min
9749 / 03	H2 PHYSICS	WRITTEN	3101	22-NOV-2017	14:00	2 hr 0 min
9753 / 01	H2 MUSIC	WRITTEN	3101	27-NOV-2017	14:00	2 hr 30 min
8872 / 01	H1 CHEMISTRY	WRITTEN	3101	29-NOV-2017	14:00	0 hr 50 min

9749 / 01	H2 PHYSICS	WRITTEN	3101	01-DEC-2017	14:30	1 hr 0 min
9753 / 21	H2 MUSIC	PRACTICAL				0 hr 25 min
9753 / 32	H2 MUSIC	COURSEWORK	3101			
9819 / 01	H3 MUSIC	PROJECT-BASED	3101			

School Code	**Centre Name**	**Address**
3101	RESERVED JUNIOR COLLEGE	12 WALKOVER STREET. SINGAPORE 345678.

The exam board wishes to manage this information using a relational database. The normalised design requires a number of tables.

(a) Draw an Entitiy-Relationship (E-R) diagram that shows these tables and the relationships between them. [4]

(b) A table description can be expressed as:

```
TableName(Attribute1, Attribute2, Attribute3, …)
```

The primary key is indicated by underlining one or more attributes.

Derive the table descriptions for the tables. [6]

(c) There are some fields with missing or null values. Explain how these arise and how a Database Management System (DBMS) may provide facilities to ensure the information is appropriately managed. [3]

(d) The DBMS also contains a report generation facility for producing formatted output. Name one component used in the report generator and how it is related to data stored in the tables. [2]

***** END OF PAPER *****