Name:		Index Number:		Class:	

DUNMAN HIGH SCHOOL
Preliminary Examination
Year 6

COMPUTING

(Higher 2)
Paper 2

9597

Additional Materials: -

READ THESE INSTRUCTIONS FIRST

Answer **all** questions.

This question paper consists of 6 questions in 8 printed pages (inclusive of this page).

The number of marks is given in brackets [ ] at the end of each question or part question.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

1. GovBuy is a Government Digital Services initiative that helps government employees buy microservices (small pieces of software that can be deployed independently), software libraries, non-critical bug fixes or even customised hardware from independent contractors.

   The platform allows government employees to post a task. Anyone can bid to take on the task during the bidding period. The reverse auction starts at $5,000 and the lowest bid wins.

   The winner works on the task and submits completed code to the team. If the code meets the acceptance criteria before the deadline, the winner is sent a cheque for the work.

   The current prototype platform is a web interface:

Auctions

Implement regex matching for LicenseFinder

Open *Ending in 8 days*   *Current winning bid: $280.00*

To whitelist licenses for license finder, users can use the command

```
$ license_finder whitelist add "Apache 2.0"
```

However, this becomes tedious and repetitive when we want to whitelist the same license, but spelt differently for different projects. For example, the Apache license could be specified as "Apache 2.0", "Apache License (2.0)", "apache, version 2.0".

Project	Type
https://github.com/idagd...	Reverse
Eligibility	Skills required
All allowed	Ruby

Add cron-based scheduling to PR Demon

Open *Ending in 8 days*   *Current winning bid: $150.00*

Currently, polling of open pull requests is done on a fixed interval. We want it to have a cron-based scheduler instead.

Project	Type
https://github.com/lawlie...	Reverse
Eligibility	Skills required
All allowed	Rust

Create ESLint autofix for eslint-plugin-react/jsx-first-prop-new-line

Open *Ending in 8 days*   *Starting price: $400.00*

As a user, I want an autofix for the eslint-plugin-react/jsx-first-prop-new-line rule.

Project	Type
https://github.com/idagd...	Sealed-bid
Eligibility	Skills required
All allowed	Javascript

### Do not spam email alerts in rcanary

Open *Ending in 8 days*   *Starting price: $400.00*

We want rcanary to not spam alerts on repeated failures.

Project	Type
https://github.com/gyng/...	Sealed-bid
Eligibility	Skills required
All allowed	Rust

(a) The agency in charge wishes to develop mobile native versions of the platform for Android and iOS. The following diagram shows the expected workflow.
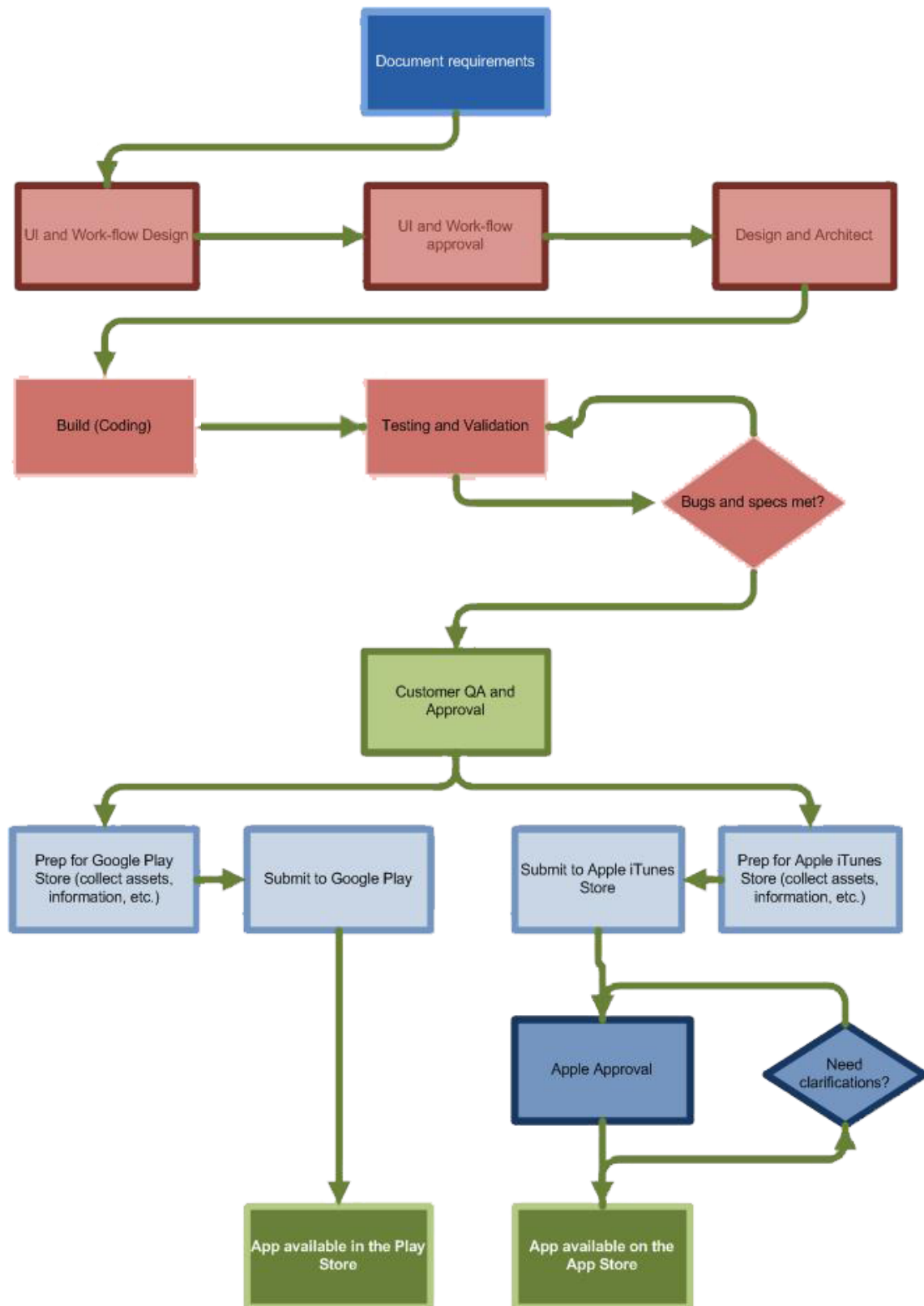
(i) Create a PERT chart from the above workflow diagram. You may assume the following durations from the activity table below. [4]

Phase	Description	Duration (weeks)
A	Gather and document requirements	2
B	UI and workflow design and approval	3
C	Design and architect	4
D	Build (coding)	7
E	Testing and validation	3
F	Customer QA and approval	2
G	Prepare and submit to Google Play Store	1
H	Prepare and submit to Apple App Store	1
I	Apple approval	1

(ii) From the PERT chart, state the critical path and the minimum project completion time.

[2]

(iii) Describe two benefits which can be gained by producing a PERT chart. [2]

(iv) Describe and give an example of a dependent activity. [2]

(v) Describe and give an example of a concurrent activity. [2]

(b) The project manager decides he needs another diagrammatic tool to monitor the project progress.

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

(ii) Explain how the Gantt chart can help the developers in carrying out their work. [2]

(c) Describe two activities to mark the closure of the project. [4]

(d) Cybersecurity is of paramount concern when it comes to government web services. Using suitable examples, explain the following cybersecurity exploits and suggest how they can be mitigated.

(i) Cross site scripting [3]

(ii) Code injection [3]

(iii) Denial of service attack [3]

(e) The platform will be hosted using cloud computing.

(i) Explain why the cloud is a suitable hosting platform. [2]

(ii) Use suitable example to illustrate the concepts of IaaS, PaaS and SaaS. [6]

(f) What ethical considerations should bidders bear in mind when bidding for tasks on an open source platform such as GitHub? [2]

2. The current GovBuy prototype supports two types of reverse auctions: a standard reverse auction and a sealed bid auction.

A standard reverse auction is one where bids begin at $5,000. The lowest possible bid is $1, and an auction automatically ends once a $1 bid has been submitted. Bidders are allowed to submit multiple bids throughout the duration of the auction. Bidders will see whether they are the winning bidder after submitting a bid, and will have an opportunity to submit a lower bid if the auction is still running. The GitHub user names of participating bidders are hidden during the auction. At the end of the auction, all bidders' GitHub accounts and bid amounts will be unsealed and posted on the GovBuy platform.

A sealed bid auction is a type of reverse auction. Each bidder is allowed to submit only one bid in an auction. Once a bid is submitted, the bidder may not submit a second bid for the same auction. The lowest bidder at the conclusion of the auction will still win the auction. In the event that one or more bidders have the same bid amount, the bidder who was first to submit the lowest bid amount will win the auction. All bids will stay sealed until the end of the auction. A bidder will not know the amounts other bidders have bidded on the auction, or how many bids have been submitted. At the end of the auction, all bidders' GitHub accounts and bid amounts will be unsealed and posted on the GovBuy platform.

(a) Illustrate the types of reverse auctions in a class UML diagram. [5]

(b) Using your illustration, explain the following OOP concepts:

  (i) encapsulation [2]

  (ii) inheritance [2]

  (iii) polymorphism [2]

3. The following code shows the program mystery1.

```
epsilon = 0.01
step = epsilon ** 2
num_guesses = 0
ans = 0.0
while abs(ans ** 2 - x) >= epsilon and ans * ans <= x:
    ans += step
    num_guesses += 1
print("#Guesses =", num_guesses)
print("Answer =", ans)
```

(a) Running the program with $x = 25$ gives the following output:
```
#Guesses = 49990
Answer = 4.999000000001688
```

  (i) What do you think is the purpose of the program mystery1? [2]

  (ii) Comment on the efficiency of program mystery1. [2]

(b) An alternative version, program mystery2 is provided as follows.

```
epsilon = 0.01
num_guesses = 0
low = 0
high = x
ans = (high + low) / 2
while abs(ans ** 2 - x) >= epsilon:
    num_guesses += 1
    if ans ** 2 < x:
        low = ans
    else:
        high = ans
    ans = (high + low) / 2
print("#Guesses =", num_guesses)
print("Answer =", ans)
```

Running the program with $x = 25$ gives the following output:
```
#Guesses = 13
Answer = 5.00030517578125
```

(i) Comment on the efficiency of program mystery2. [2]

(ii) For x = 123456, mystery1 gives the following output:

```
#Guesses = 3513631
Answer = 351.36309998343665
```

Justify a reasonable estimate for the number of guesses for mystery2 for x = 123456? [2]

4. Given a list of integers, the task is to find the number with the highest occurrence.
   Describe and devise an algorithm for this task using:

(a) array [4]

(b) binary search tree [4]

(c) hash table / dictionary [4]

5. In ASCII, the decimal representation of the uppercase letter 'A' is 65. Uppercase letters precede their lowercase equivalents with the offset amount 32.

(a) Determine the decimal representation of the lowercase letter 'g'. [2]

(b) State the range of ASCII in decimal. [1]

(c) In Unicode, the legal range of codepoints is U+0000 through U+10FFFF. How many potential characters can be represented in decimal? [2]

(d) Devise an algorithm utilising a stack to convert a non-negative integer from decimal to hexadecimal. [5]

6. HonestBee is an end-to-end online grocery ordering and delivery service. When a customer makes orders from a grocery store, a concierge shopper handpicks the best products, and a delivery bee brings the groceries to the customer's doorstep. The following online cart page shows the current order of a customer:

In the event that the item is out of stock, the customer can also opt for 3 options:

Pasar Fresh Eggs
10/pack

$1.70

✓ Same price as in store

IF OUT OF STOCK

✓ Let shopper suggest
Choose a substitute now
Don't substitute

INSTRUCTIONS FOR YOUR SHOPPER

Instructions for your concierge shopper, e.g. pick milk with at least 5 days to expiry.
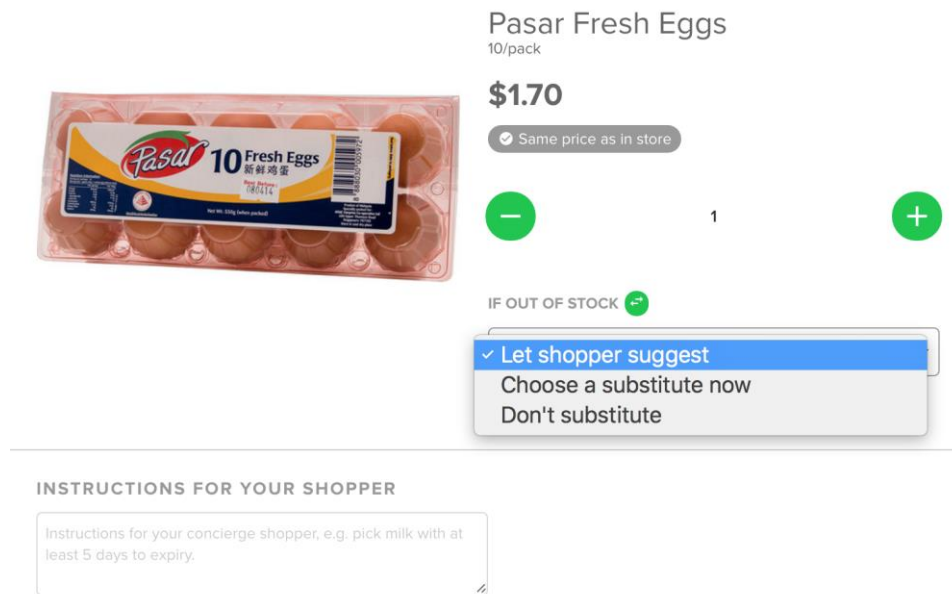
(a) Produce a normalised relational database schema showing the table specifications.   [8]

(b) Draw an ER diagram illustrating the entities and their relationships.   [3]

(c) Using suitable examples from this context, explain the concepts of

 (i) primary key (for the Customer table)   [2]

 (ii) composite key   [2]

 (iii) foreign key   [2]

(d) Orders below $30 is charged a delivery fee of $10, else delivery fee is waived. Some orders may incur a concierge fee for special instructions. Where should fields such as delivery fee and concierge fee be stored? Why?   [2]

END OF PAPER