

Title: Untitled-32  
Creator: FreeHand 10.0  
Preview: This EPS picture was not saved with a  
preview (TIFF or PICT) included in it.  
Comment: This EPS picture will print to a  
postscript printer but not to other types of  
printers

**2004 SCHOLARSHIP EXAMINATION**  
**WRITTEN SECTION**

DEPARTMENT	Computer Science
PAPER TITLE	7 <sup>th</sup> Form Scholarship
TIME ALLOWED	Two Hours
NUMBER OF QUESTIONS IN PAPER	Twelve
NUMBER OF QUESTIONS TO BE ANSWERED	Twelve
VALUE OF EACH QUESTION	The value of each question is indicated
GENERAL INSTRUCTIONS	Answer ALL TWELVE questions in the Answer Booklet provided.
SPECIAL INSTRUCTIONS	Nil
CALCULATORS PERMITTED	No

TURN OVER

**SECTION A**  
**COMPUTING CONCEPTS**

1. A 16 bit unsigned integer can hold a value in the range 0 to 65535. Therefore it requires at most 5 digits to write it down in base 10. How many digits may be required to write down the value of an unsigned 32 bit value in:
  - (a) Octal (base 8)
  - (b) Hexadecimal (base 16)
  - (c) Decimal (base 10)

(5 marks)

2. Multiply the two eight bit binary numbers 00000011 and 00001101. Show your work, including carry bits.

(5 marks)

3. Real numbers (floating point numbers) are stored in the variables X and Y. Later the value  $Y / X$  (Y divided by X) must be calculated and stored in the variable Z. Sometimes the program fails while performing this calculation. Why would this happen? The programmer tries to fix the problem by writing:

if X does not equal 0.0 then set Z to  $Y / X$

The error happens less often, but the program still sometimes fails. Explain?

(5 marks)

4. Sometimes adding two positive integers in a computer program produces a negative result. Explain!

(5 marks)

5. My computer usually runs several programs at the same time. For example I can have a word processor, a web browser and a spreadsheet all running simultaneously. Sometimes however, I run an old calculator program. It just waits for me to type in numbers to add, subtract, multiply *etc.*, and gives answers when I want them. When this program is running everything else on my computer seems slow and unresponsive. What might be happening?

(5 marks)

6. When I was buying a new computer to use for game playing recently, the salesperson told me that it was more important to invest in a good graphics card, than it was to have a particularly fast processor. Was this good advice? What functions does a graphics card perform on a modern computer system?

(5 marks)

CONTINUED

7. You are responsible for managing 100 computers interconnected by a 10 Megabit/second network system. Each computer has a 20 GByte hard disk. On average these disks have 10 GB of installed software and 5GB of data belonging to the people using them. You have installed a new network backup device, with very large storage capacity. If no other use were made of the network, how often could you back up each computer? What steps could you take to improve the frequency of backups?

(5 marks)

**SECTION B**

**PROGRAMMING**

**Note:** In answering questions 8 – 11 you should notice that the question wording fails to explain what your program fragment should do in some situations. Where this is the case you should describe the problem, choose and implement a solution. Marks will be awarded for this analysis.

8. Write a code fragment to display a triangle of asterisks 20 rows high and 20 asterisks wide at the bottom, like this:

```
*
**
***
****
*****
*****
*****
*****
*****
*****
*****
*****
*****
*****
*****
*****
*****
*****
*****
*****
```

(5 marks)

9. Write a program fragment to write a triangle shape with M rows and M characters wide at the bottom, where M is an integer value in the range 10 to 30. The stripes should be two asterisks or spaces wide. Start with a complete asterisk stripe at the top right. You may end up with an incomplete fragment in the lower left corner. When M is 20 your triangle should look like this

```
*
**
 *
  **
*   **
**  **
 *  **
  **
*   **
**  **
 *  **
  **
*   **
**  **
 *  **
  **
*   **
**  **
 *  **
  **
**  **
 *  **
  **
**  **
```

(5 marks)

10. Write a program fragment to write a triangle shape with M Rows, M characters wide at the bottom, and stripes that are W asterisks or spaces wide. The picture with question 9 shows the case with M=20 and W=2.

(7 marks)

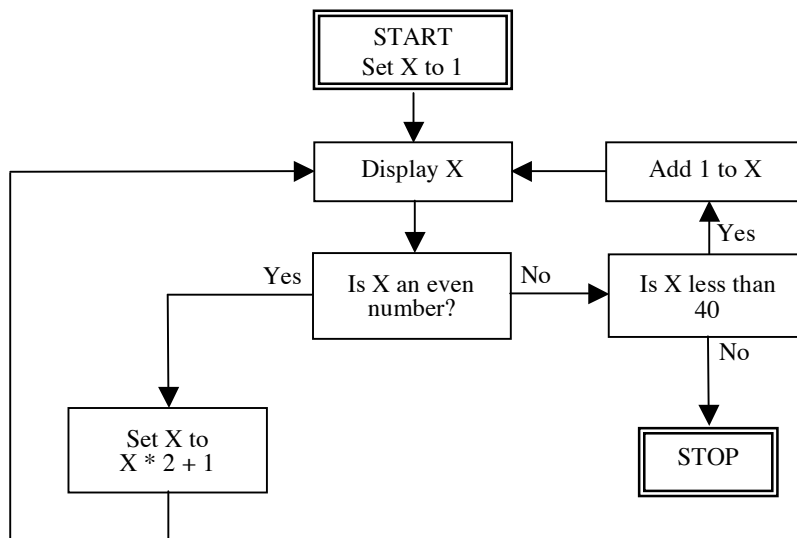
11. An array V holds N numbers, where N is in the range 10 to 1000.

- (a) Write a code fragment to calculate the average of the numbers. (5 marks)
- (b) Write a code fragment to calculate the largest and smallest of the numbers. (5 marks)
- (c) Write a code fragment to calculate the average of the numbers, omitting the largest and smallest values. (8 marks)

**SECTION C**

**PROBLEM SOLVING**

12. Consider the algorithm described in this flow chart.



- (a) Write down the values that are displayed by this algorithm. (5 marks)
- (b) What will happen if the algorithm starts with X set to -10 (minus 10) instead of 1(in the top centre box). (5 marks)
- (c) What would happen with other starting values for X. You should analyse the algorithm and explain what will happen for all possible 16 bit integer values used as starting values for X. (20 marks)