



Section A

Question 1

When the start/lap button is pressed

IF (time is not being measured)
start timing
remember that time is being measured

ELSE
IF (display is not frozen)
freeze display
remember that the display is frozen

ELSE
Unfreeze display
Remember that the display is not frozen
Display elapsed time

When the stop button is pressed

IF(time is being measured)
stop timing
remember that time is not being measured

When the reset button is pressed

IF (time is not being measured)
Reset the time to 0:00:00.0

Question 2

When Button B is pressed

IF (playing)
IF (chapter number<4) set chapter number to chapter number+1
ELSE set chapter number to 1
Advance to chapter

When Button D is pressed

IF (!pressed)
Set pressed to true
Start Advancing process
ELSE
Set pressed to false
Stop Advancing process

Advancing Process:

```
    While true
{
Elapsed time = Elapsed time + 5;
Wait 1 second
}
```

When Button A is pressed

```
    IF (!playing)
        Play DVD
        Set playing to true
    ELSE
        Stop DVD
        Set playing to false
```

Question 3

a)

Initialising the Pump

```
    Set total to 1000ml
    Set dosage to 0 ml
    Set go to false;
```

When the Go Button is pressed

```
    IF (!go)
        Set go to true
        Start Dispensing process
    ELSE
        Set go to false
        Stop Dispensing process
```

Dispensing process:

```
    While (true)
    {
        Dispense dosage
        Set total to total –dosage
        Sleep
        If (total<=100) start beeping
    }
```

There were a number different of solutions to questions in this section that were accepted. This particularly applies to questions 2 (b) and 3 (b).

Candidates need to ensure that they attempt to structure the answer using if statements etc, rather than simply restating the question. It is also important to use the given variables rather

than using their own or a phrase. For example where “If (playing)” was required some candidates used “If movie is playing”.

Candidates should also be careful of logic errors in the algorithm. A common example is code such as:

If (playing) set playing to false;

If (!playing) set playing to true. Which will always finish with playing = true.

Section B

Question 4

a)

actionperformed()
getSource()
getText()
parseInt()
repaint()

b)

sum(0)
will give us 50+25+39+35+16
=165

count(0)
will return 5

Question 5

a) No objects were greates

b) sorted(0)
s is false

c)divisions(0)

t = “ 1 tens 2 fives and 2 others”

Question 6

a)

d= 50+25-39/35%16*3
=50+25-1*3
=72.0

- b) The action performed Method will cause the stats to be printed if the statsB Button has been pressed as the variable showStats is set to true, otherwise it will put the entered number into the array of nums. (eg nums[1]=25)

```

Statistics for row one:
*****
Sum is 165
Count is 5 out of 5
Sorted is false
Divisions is 1 tens 2 fives 2 others
Magic is 72.0

```

- (c) Given that a magic square generally uses the numbers from 1 to (DIM*DIM) and we are using random numbers between 1 and 100 this program will not generate a true magic square. The program does not make an attempt at adding columns and does not check for a consistent sum.

This was a very difficult section of the paper. It gave average candidates little or no opportunity to display what they did know, and much opportunity to be 'thrown' by the length, complexity and incomplete exploration of the applet.

Having said that (and much more could be added!) many earnest attempts were made to answer the section.

A disappointingly large number of candidates could not identify which methods were called by an action event - and quite a number mis-identified variables as methods. On the other hand, a pleasing number correctly evaluated the results of calls to methods, despite the unusual - at this level - use of loops. Also confusing at this level was the use of an array which more properly should have been two-dimensional - and therefore clearly outside the scope of the course.

No candidate provided any worthwhile response to question 6 (c).

The questions provided little, if any progression in difficulty, and started well beyond the capacity of an average candidate.

Overall, this was a disappointing section which prevented candidates from demonstrating their knowledge, rather than enabling that demonstration.

Section C

Question 7

- a) $-31 = \text{MSB } 10011111 \text{ LSB}$
- b) $-5 = -0101$
 $= 1011$

c) 00011 01111 01110 10110 00101 10010 10100
 3 15 14 22 5 18 20
 C O N V E R T

Question 8

a) 0.9 -0.3

```
.11100
-  .01001
  .10011
```

= 0.5+ 0.0625 0.03125
 =0.59375

(b) Since 0.9, 0.3 and the correct answer of 0.6 cannot be exactly represented in binary the answer is an approximation. The more bits used the closer the approximation.

Question 9

a) JPEG is designed for compressing either full-color or gray-scale images of natural, real-world scenes. JPEGs work well on continuous tone images like photographs or natural artwork; not so well on sharp-edged or flat-color art like lettering, simple cartoons, or line drawings. JPEGs support 24-bits of color depth or 16.7 million colors ($2^{24}=16,777,216$ colors), however it is based on a lossy algorithm. JPEG works by converting the spatial image representation into a frequency map. A Discrete Cosine Transform (DCT) separates the high- and low-frequency information present in the image. The high frequency information is then selectively discarded, depending on the quality setting. The greater the compression, the greater the degree of information loss. If the compression used was only 3 bit this would reduce the range of colours to $2^3= 8$. Thus it is unlikely that the compression algorithm would be suitable for compressing photographs.

b)

```
for (int down =0; down<600; down++)
    for (int across=0; across<800; across++)
        get red value from current pixel
        get green value from current pixel
        get blue value from current pixel
        set grey to (red+green+blue)/3
        store grey
```

c) $2^9=512$ so 9 bits are required.

This section was well done with 18% A, 34% B, 37% C and 15% T ratings.

Question 7

This question was very predictable and very well done. Candidates need to answer all parts of the question (ie indicate the least and most significant bits) and take care with their calculations (ie there were lots of interesting alternative answers to *convert*).

Question 8

This question was also very predictable although many candidates struggled to convert to fixed point representation and subtracting the numbers (with a lot of “*borrowing*” required) caused difficulties. Part (b) was well done but that was hardly surprising since the answer was on the previous exam solutions!

Question 9

This question was almost identical to 2006 so many candidates wisely copied the answer for part (a). Less wisely, some candidates also copied the answer for part (b) when the question had actually been changed. More able candidates took the algorithm from 2006 and adapted it correctly. Part (c) was rather easy and well done.

Section D

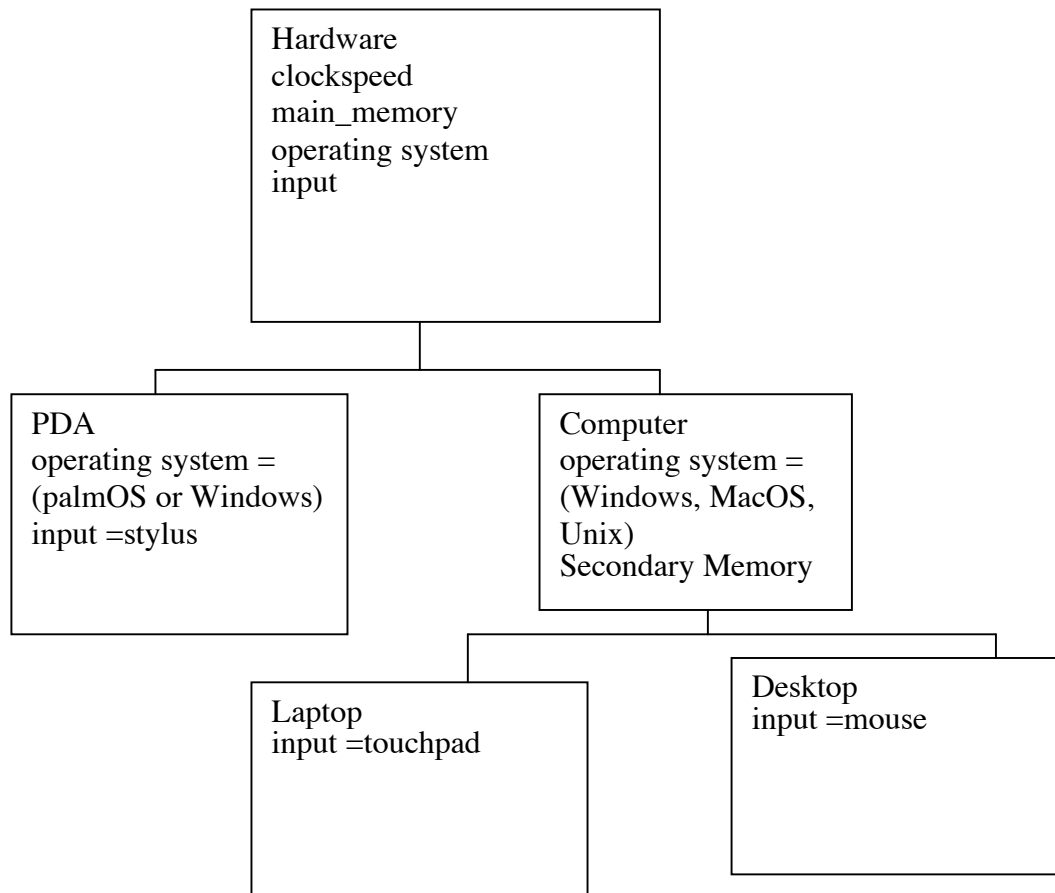
Question 10

The diagram shows a user interface for a music player. It consists of a large rectangular frame containing several elements:

- A box labeled "Album Image" on the top left.
- A box labeled "Album Name" and a box labeled "Artist Name" stacked vertically below it.
- A box labeled "Song .." on the top right, with a vertical double-headed arrow next to it.
- Four circular buttons at the bottom labeled "<<", "0", ">", and ">>".

Songs – Choice drop down Menu
Album Name and Artist Name – Textfields
4 Buttons on the bottom of the screen.

Question 11



Hardware

Methods shutdown(), restart()

PDA

Methods suspend() wakeup()

Computer

Laptop

suspend() wakeup() hibernate()

Question 12

```
Fish flathead;
Animal wombat
flathead = new Fish(0.25, 1.1, "Flathead", 3, false);
wombat= new Animal(0.8, 14.2, "Wombat");
```

b) isPoisonous only applies to Fish so cannot apply to the wombat

```
String des= flathead.getDescription();
String des2= wombat.getDescription();
```

c)public class Bird extends Animal

```
{
    private double wingSpan;

public Bird (double l, double w, String s, double ws)
{
    super(l,w,s);
    wingspan=ws;
}

public double getWingSpan()
{
    return wingspan;
}

public void fly (Distance m, Direction c)
{....
}

public void migrate(Path p)
{
    .....
}
}
```

The majority of candidates were able to give a reasoned answer to Question 10 ensuring there were few “t” ratings on this section.

There were many different interpretations of Question 11. One major area of difference was whether actions such as suspend were boolean variables or methods. Both solutions were accepted, although most candidates ignored the question which asked them to state the methods. Those that did no, have varied answers such as the one specified above or included

methods to set and get values. Again both options were accepted. A large number of candidates did not understand inheritance within Java and had subclasses inheriting from multiple superclasses.

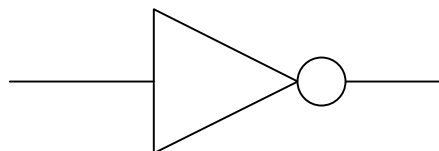
Question 12 was often better done than Question 11. Many candidates had difficulty deciding whether a wombat was a fish or animal as there was not a variable to record the number of legs in animal. A number of candidates also indicated that the `isPoisonous()` method would not function on either example as neither was in fact poisonous. Again there were a number of interpretations of the Bird class so a number of answers were acceptable.

Section E

Question 13

Error detection and/or correction is used to determine whether an error in transmission may have occurred. Extra information is calculated on the data to be sent over a network and incorporated with the data messages. When the data reaches the destination the calculations are redone and compared against the included information. If the results do not agree then a transmission error has occurred in which case data may be resent or if sufficient data is included, corrected at the destination. A parity check is an example of a simple detection system.

$$\begin{aligned}
 & ((\sim A) \wedge (\sim B)) \vee \sim(A \vee (\sim B)) \\
 & = ((\sim A) \wedge (\sim B)) \vee (\sim A \wedge (\sim \sim B)) \\
 & = ((\sim A) \wedge (\sim B)) \vee (\sim A \wedge (B)) \\
 & = (\sim A) \wedge ((\sim B) \vee B)) \\
 & = (\sim A) \wedge T = \sim A
 \end{aligned}$$



- (a) Was poorly done. Candidates showed lack of understanding of why error detection is used. Many assumed error detection was a preventative measure. They missed the point that errors need to be detected before they can be fixed.
- (b) Required candidates to carefully read the question. Any simplified expression was accepted, together with a logic diagram that matched the expression. The skill of converting a logic expression into a logic diagram was clearly lacking for a number of candidates.

Question 14

a)

The IP address is Class B.

Bits borrowed=10

Number of usable subnets = $2^{10}-2=1022$

The number of usable addresses per subnet is $2^6-2=62$

First usable subnet 131.217.0.65 to 131.217.0.126

Last usable subnet 131.217.255.129-131.217.255.190

- (ii) MAC addresses are 48 bit addresses. Addresses are unique for each NIC with the first 24 bits representing the vendor and the last 24 a number provided by the manufacturer, used as a serial number. Thus there are $2^{48} = 281474976710656$ available MAC addresses. These numbers are burnt into ROM. (eg AA:B1:FC:23:14:1A is an example)

IPv4 addresses are 32 bit addresses which can be expressed in dotted decimal form. The number of these addresses has been reduced by the class system from the theoretical 2^{32} .

This means that the number of available MAC addresses is vastly larger than the number of IPv4 addresses, and so is unlikely to run out any time soon.

OR b

Instruction	Acc	A	B	C	D
LD B	3	1	3	0	15
ST D	3				3
BLZ LOOPB					
LD C	0				
ADD B	3				
ST C				3	
LD B	3				
SUB A	2				
ST B	2		2		
B LOOPA					
LD B	2				
ST D					2
BLZ LOOPB					
LD C	3				
ADD B	5				
ST C				5	
LD B	2				
SUB A	1				
ST B			1		
B LOOPA					
LD B	1				
ST D					1

BLZ LOOPB					
LD C	5				
ADD B	6				
ST C				6	
LD B	1				
SUB A	0				
ST B			0		
B LOOPA					
LD B	0				
ST D					0
BLZ	LOOPB				
LD C	6				
ADD B	6				
ST C				6	
LD B	0				
SUB A	-1				
ST B			-1		
B LOOPA					
LD B	-1				
ST D					-1
BLZ LOOPB					
LD D	-1				
ST B			-1		
BLZ END					
H					

(i) $C=6$

(ii) while ($b \geq 0$)
 { $c=c+b$;
 $b=b-a$;
 }

or the addition version of the factorial function in mathematics,

or

$$B = \sum_{r=1}^C r$$

(a) (i) Was also very predictable and well done although some candidates failed to recognise the IP address as being from Class B.

(ii) Was also well done as many candidates supplied reasoning for their answer.

- (b) as generally well done by all those who attempted the question. Some candidates recognised that Loop B was never executed. Many candidates rewrote the algorithm in words when attempting to state what the program did, when relating the algorithm to what happened to the values involved would have been more useful.

Question 15

The Transport layer is responsible for providing reliable data transfer between users. The transport layer controls the reliability of a given link through flow control, segmentation/desegmentation, and error control.

The data unit that the Transport layer deals with is called a segment. A segment contains a variety of information, such as port numbers, application headers, sequence numbers, destination information and actual data.

The transport layer keeps track of segments and retransmits those that fail to reach their destination. TCP is an example of a protocol that works in the transport layer.

The transport layer interacts with other layers above and below its position in the OSI model. In sending information, the transport layer interacts with both the session layer just above its position and sometimes with the presentation layer above that if the session layer is not implemented. Information received from the layers above is segmented and wrapped with additional information to identify source and destination points of origin, applications and message identification. Once this is completed, the transport layer hands the segment complete with all the wrappers to the network layer for transmission. The network layer works out how to get the segment to its destination.

In receiving information, the transport layer receives a segment and its wrappers from the network layer. The wrapper information is stripped from the segment and is used to re-assemble the original message. This message is then passed to the layers above where it is delivered to the appropriate destination application.

OR

The Domain Name System (DNS) is a distributed database used by TCP/IP to map hostnames and IP addresses, and to provide electronic mail routing information. The main use of DNS is to replace user- unfriendly IP address numbers with readable user-friendly names. The DNS system allows IP address-name translation in either direction: forward or reverse.

The DNS uses a hierarchical naming scheme known as domain names. A domain name server (DNS) responds to requests from clients to translate a domain name into the associated IP address. The DNS system is set up in a hierarchy that creates different levels of DNS servers. To make a DNS request, a computer will send a UDP packet to a DNS server.

If the DNS server cannot resolve the address it passes it up to the next level DNS. The process repeats until the address has been translated or until the top level DNS is reached. If the top level DNS can't resolve the address, it is considered to be an error.

DNS servers also supply information as to the address of email servers in a named domain.

Comments

- (a) Required candidates to be familiar with their notes. Many copied whole pages from their notes but did not indicate understanding of what they wrote. Many candidates did not relate activity in the Transport Layer to the layers above and below in the ISO model very well.
- (b) Also required candidates to be familiar with their notes, but this question was completed much better than Question 15(a). Most candidates were able to state that DNS increased user friendliness, but failed to mention reverse lookups or how DNS requests were enacted. Many candidates erroneously concentrated their answers on domain name organisation.

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