

Solutions

Computing Intermediate Matsec Exam May 2013

A1

- a. The purpose of the fetch-execute cycle is to copy the next instruction to be executed from RAM to the CPU and then execute the instruction.
- b. In the fetch phase the CPU asks the RAM to send the next instruction. This is done by sending (1) the contents of the PC register on the address bus and (ii) the command 'read' on the control bus. In the execute phase the control unit in the CPU interprets the command found in the CIR (IR) and accordingly sends orders to the ALU to perform the required operations.

A2

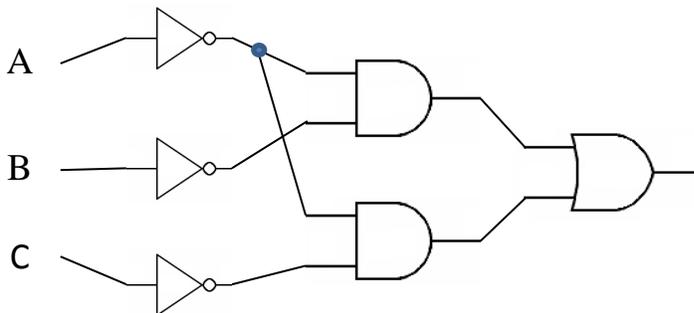
a.

A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

- b. Finding the minimum expression by means of the Karnaugh map.

	AB	AB'	A'B'	A'B
C			1	
C'			1	1

This gives $F = A'B' + A'C'$



A3

- a. real-time
- b. single-tasking

- c. hard real-time
- d. soft real-time
- e. multi-tasking
- f. batch

A4

- a. relational database
- b. Data normalization is the process of organizing the fields and tables to minimize redundancy and dependency. Normalization usually involves dividing large tables into smaller (and less redundant) tables and defining relationships between them. The objective is to isolate data so that additions, deletions, and modifications of a field can be made in just one table and then propagated through the rest of the database using the defined relationships.
- c.
 - i. First Normal Form: A relation is in 1NF if, and only if, it contains no repeating attributes or groups of attributes.
 - ii. Second Normal Form: A relation is in 2NF if, and only if, it is in 1NF and every non-key attribute is fully functionally dependent on the whole key (i.e. there are no partial key dependencies).
 - iii. Third Normal Form: A relation is in 3NF if, and only if, it is in 2NF and there are no transitive functional dependencies. Transitive functional dependencies arise when one non-key attribute is functionally dependent on another non-key attribute.

A5

- a. Database administrator.
- b.
 - i. Data independence (data in the database can be structurally changed without affecting existing programs)
 - ii. Data integration (data integration involves combining data residing in different sources and providing users with a unified view of these data)
 - iii. Relationships between records in different files
- c.
 - i. External schema for user views
 - ii. Conceptual schema integrates external schemas
 - iii. Internal schema that defines physical storage structures

A6

- a. Network topology deals with the way computers are connected together in a network.
- b. There is more than one path joining two computers together. If one is not available or contains too much traffic then an alternative one can be found.

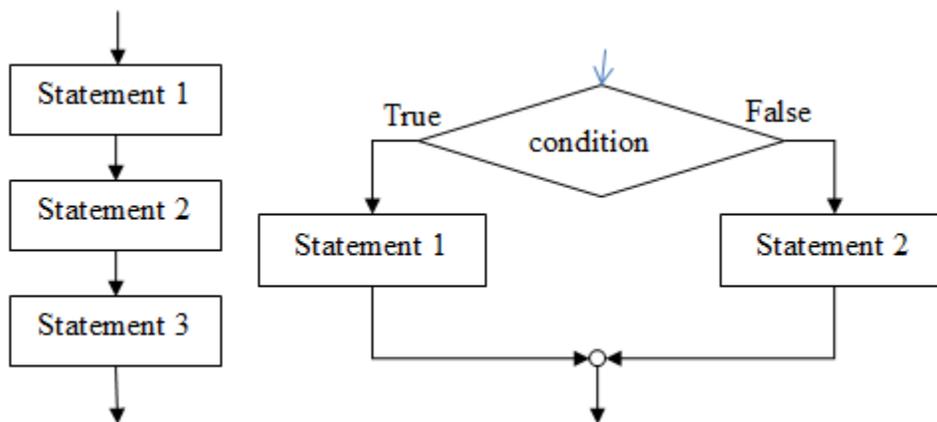
- c. (1) The performance of the ring network is better than that of a bus topology since there are no collisions as the data flows in one direction only. (2) Another advantage is that there is no need of a server.
- d. e-mail
- e. If a packet gets corrupted only that packet needs to be re-sent and not a whole file.

A7

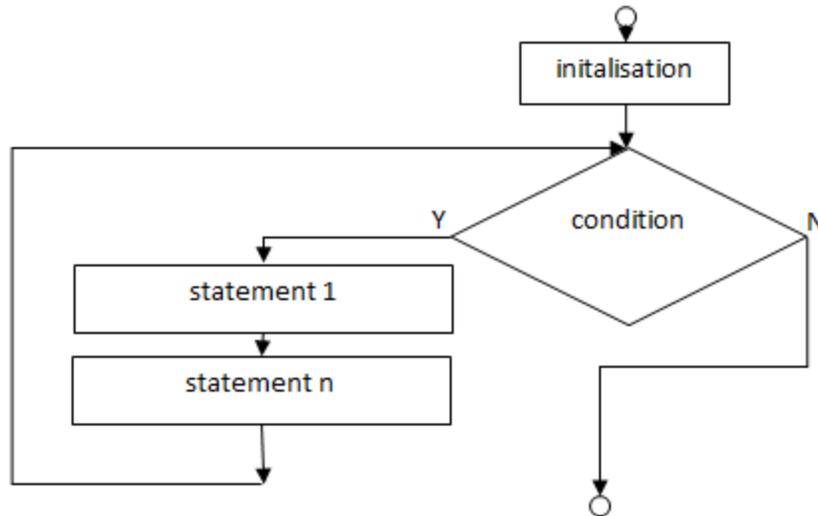
- a.
 - i. Internet banking
 - ii. Online shopping
- b.
 - i. More time in hand – no queues
 - ii. Wider choice of items and prices
- c. They can follow courses at their own (fast) rate
- d.
 - i. They may lack the right technology e.g. speech synthesizer for the blind.
 - ii. They may lack the human and affectionate approach.

A8

- a. Flowcharts and pseudocode both give a description of an algorithm. However the flowchart is pictorial while the pseudocode uses words in English and is arranged in a program structure.
- b.



Referring to the above diagrams the Sequential construct (left) shows that statements are executed one after the other. The Selection construct (right) shows that a program following a condition can proceed one way or another.



Above is the repetitive construct which permits a programmer to repeat sections of code while a given condition is true

c.

- In process control the selective structure is very important as the program has to decide for example whether air conditioners should be switched on or off.
- In process control the repetitive structure is always present as the process would be repeated for number of times.

A9

$$\begin{array}{r}
 (a) \quad 23_{10} = \begin{array}{ccccccc} 0 & 0 & 0 & 1 & 0 & 1 & 1 \\ \hline & -128 & 64 & 32 & 16 & 8 & 4 & 2 & 1 \end{array} \\
 35_{10} = \begin{array}{ccccccc} 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ \hline & & & & & & & & \end{array} + \\
 -23_{10} = \begin{array}{ccccccc} 1 & 1 & 1 & 0 & 1 & 0 & 0 & 1 \\ \hline \times & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{array}
 \end{array}$$

- b. maximum = $01111111_2 = 127_{10}$
 minimum = $10000000_2 = -128_{10}$

c. Two advantages:

- Arithmetic operations in two's complement are easier to do than in sign and magnitude.
- In the sign and magnitude -128 is not represented (because there are two representations for zero).

A10

a.

- Java, Cobol, Pascal

- ii. Java, C++
- iii. Java, etc. (any computer language)
- b.
 - i. `Account account1 = new Account();`
 - ii. `account1.findInterest();`
- c. Static methods are invoked with the class name, without the need for creating an instance of the class, while instance methods are invoked from objects.

B1

- a)
 - i) EFT: Electronic funds transfer is a system of transferring money from one bank account directly to another without any paper money changing hands e.g. when one pays purchased goods by means of a credit card. One problematic issue can be data theft by means of which card numbers together with the associated passwords or pin numbers can be stolen.
 - ii) E-mail is the exchange of computer-stored messages by telecommunication. Messages arrive almost instantly and can carry various attachments. A message can be forwarded to more than one person. One difficulty with email is spam which is unsolicited mail.
- b)
 - i) (1) Access key: when installing the program an access key has to be entered. This access key is given at time of purchase. (2) Make programs requiring an Internet connection to run. The programs are only allowed to run if they are registered.
 - ii) It protects them by law. A person who performs an act of software piracy if caught and reported can be brought to court and punished.
 - iii) viruses, denial-of-service attacks, phishing
- c)
 - i) Open source software is software whose source code is available for modification or enhancement by anyone. Some software has source code that cannot be modified by others. This kind of software is frequently called "proprietary software" or "commercial software". Some open source licenses ensure that anyone who alters and then shares a program with others must also share that program's source code without charging a licensing fee for it. Both open-source and commercial software come with a fee.
 - ii) Selling it, commercials
- d)
 - i) The data protection act was necessary to protect the user's privacy on their personal data. It also protects the users' rights to know what data about them is being kept in any database. A user has the right to ask any organization what data is being kept about him/her. Data cannot be sold or shared without the users' consent.

- ii) Two principles of the Data Protection Act are the following: (1) Personal data shall be obtained only for one or more specified and lawful purposes, and shall not be further processed in any manner incompatible with that purpose or those purposes. (2) Personal data shall be adequate, relevant and not excessive in relation to the purpose or purposes for which they are processed.
- e) Plagiarism is the unauthorized use of the language and thoughts of another author and the representation of them as one's own.
- f) Two characteristics of Web 2.0 are: collaboration and information sharing. This can be achieved by means of blogs and wikis.

B2

- a) ROM: read-only memory, PROM: programmable ROM, EPROM: erasable programmable ROM, EEPROM: electrically erasable ROM
- b)
 - i) EEPROM
 - ii) PROM
 - iii) EPROM
 - iv) ROM
- c)
 - i) Immediate, direct, symbolic
 - ii) Immediate addressing (data is found inside the instruction itself) e.g. 'LDA #12' means: load 12 into A (the accumulator).
Direct addressing (data refers directly to a location in memory) e.g. 'LDA 523' means: load the contents of address 523 into A.
Symbolic addressing (instead of data referring to an address it refers to a name – symbol e.g. 'LDA num' means: load the contents of num into A.
 - iii) LDA #12: opcode is LDA and operand is 12
LDA 523: opcode is LDA and operand is 523
LDA num: opcode is LDA and operand is num
- d)
 - i) number, character, address (all in binary)
 - ii) A stack is a part of memory that stores its data in a Last-in-first-out way. The operations are Push and Pop.
 - iii) The zero flag is a bit that is equal to 1 if the last operation resulted in a zero. Otherwise it is equal to zero. It can be used to see if a comparison was true (result is 1) or false (result is zero).