

**1. Full answer with explanations(a)(i):**

Pixel: A single square of one colour, The smallest addressable element in an image

File header: Data about the bitmap image (e.g. number of colours)

**Full answer with explanations(a)(ii):**

To calculate the file size, we can use the formula:

$$\text{File Size} = (\text{Image Width} \times \text{Image Height} \times \text{Color Depth}) / 8$$

Given that:

- Image resolution: 1024 × 512 pixels
- Color depth: 8 bits per pixel

Substitute these values into the formula:

$$\text{File Size} = (1024 \times 512 \times 8) / 8$$

Simplify the expression:

$$\text{File Size} = 4096 \text{ kilobits}$$

Now, convert kilobits to mebibytes:

$$\text{File Size} = 4096 \text{ kilobits} / (8 \times 1024)$$

$$\text{File Size} \approx 0.5 \text{ Mebibytes}$$

Therefore, the estimated file size is approximately 0.5 Mebibytes.

**Full answer with explanations(b):** One method of lossless compression that can be used is Run-Length Encoding. In Run-Length Encoding, sequences of the same color pixel are replaced with a single value and the number of times it repeats. This reduces redundancy in the image data. For example, if there is a row of pixels where each pixel has the same color, instead of storing each pixel individually, Run-Length Encoding would represent the color and the number of consecutive times it appears. This way, it optimizes the representation of repeated patterns or sequences, effectively reducing the file size without losing any image information when decompressed.

**Full answer with explanations(c)(i):**

To convert the hexadecimal code FC into denary (decimal), you can use the following conversion:

$$16 = (15 \times 16^1) + (12 \times 16^0) \quad FC_{16} = (15 \times 16^1) + (12 \times 16^0)$$

$$16 = (15 \times 16) + 12 \quad FC_{16} = (15 \times 16) + 12$$

$$16 = 240 + 12 \quad FC_{16} = 240 + 12$$

$$16 = 252 \quad FC_{16} = 252$$

Therefore, the denary equivalent of the hexadecimal code FC is 252.

**Full answer with explanations(c)(ii):**

Converting 15 to binary 0000 1111

Method for addition

Final answer

$$\begin{array}{r} 0010 \ 0011 \\ + 0000 \ 1111 \\ \hline 0011 \ 0010 \\ 1 \ 111 \end{array}$$

**Full answer with explanations(c)(iii):**

Converting -10 to two's complement binary 1111 0110

Adding values

Final answer 0001 1001

10 = 0000 1010

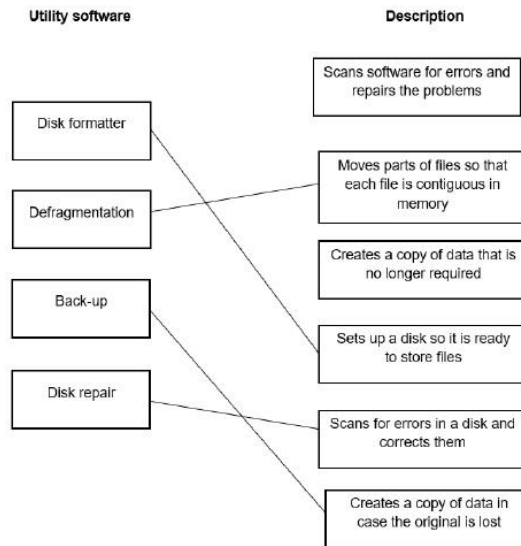
-10 = 1111 0110

$$\begin{array}{r} 0010 \ 0011 \\ + 1111 \ 0110 \\ \hline 0001 \ 1001 \\ 11 \ 11 \end{array}$$

**Full answer with explanations(d):** Copyright refers to the formal and legal rights to ownership, often described as intellectual property rights, associated with creative works. It provides protection against unauthorized reproduction of the work by granting the creator exclusive rights to its use, distribution, and adaptation. Copyright establishes a legal framework that allows the creator to control how their work is used and ensures they have the right to seek legal redress in case of unauthorized or infringing activities.

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**2. Full answer with explanations(a):**



**Full answer with explanations(b):** Four key management tasks that the Operating System will perform include:

- Memory management: Organizing and allocating system memory for processes.
- File management: Handling the creation, organization, and deletion of files and directories.
- Security management: Enforcing access controls and ensuring the security of the system and its resources.
- Hardware/device/peripheral/resources management: Managing and coordinating hardware devices, peripherals, and system resources for efficient operation.

**3. Full answer with explanations(a):**

The Program Counter holds the address of the next instruction to be loaded.

This address is sent to the Memory Address Register.

The Memory Data Register holds the data fetched from this address. This data is sent to the Current Instruction Register and the Control Unit decodes the instruction's opcode.

The Program Counter is incremented.

**Full answer with explanations(b):**

Instruction address	ACC	Memory address				IX	Output
		365	366	367	368		
200	1	1	3	65	66	0	
201							
202							
203	2						
204		2					
205						2	
206	65						A
207							
208							
200	2						
201							
202							
203	3						
204		3					
205						3	
206	66						B
207							
208							
200	3						
201							
202							
209							

**Full answer with explanations(c)(i):** 1 1 0 1 0 1 0 0

**Full answer with explanations(c)(ii):** The number is divided by 8 (and only whole number retained)

- 4. Full answer with explanations(a):** The key features of a peer-to-peer network are: All computers are of equal status, meaning that there is no centralized server or hierarchy among the connected computers. Each computer in the network provides access to resources and data. In a peer-to-peer network, data is distributed across the connected computers, and each computer can share its resources with others on the network.

**Full answer with explanations(b):** Two drawbacks of using a peer-to-peer network for Melinda and her friends are: 1. Reduced security: In a peer-to-peer network, there is no central management of security. The network is only as secure as the weakest computer on it. Each computer is at risk from viruses and malware from other computers in the network.

2. No central management of backup: Since there is no central management of backup in a peer-to-peer network, if the data from one computer is not backed up, it is at risk of being lost to all the computers in the network. This lack of centralized backup management can lead to data loss if individual users do not take adequate measures to safeguard their information.

**Full answer with explanations(c)(i):**

Task	Performed by router	Not performed by router
Receives packets from devices	✓	
Finds the IP address of a Uniform Resource Locator (URL)		✓
Directs each packet to all devices attached to it		✓
Stores the IP and/or MAC address of all devices attached to it	✓	

**Full answer with explanations(c)(ii):** Wireless

Justification:

- Freedom of movement: Melinda can move between different rooms with a mobile device and still receive/transmit data, providing flexibility and convenience.
- No need for a physical connection: The absence of physical cables allows for easy mobility and eliminates the need for a wired connection.
- Easily expanded if friends want to access the same network: Wireless networks can be easily expanded to accommodate additional devices without the constraints of physical cables.
- Less cabling/expertise is needed: Setting up a wireless network requires less cabling and technical expertise, making the initial setup less expensive and more user-friendly.

**Full answer with explanations(d):** Melinda is using both the internet and the World Wide Web (WWW) when she sends emails from her webmail account. She is using the internet because she is sending data over the infrastructure, and she is using the WWW because she accesses a website (her webmail account) that is stored on a web server, and this web server is part of the World Wide Web.

- 5. Full answer with explanations(a):** An embedded system, as exemplified by the washing machine, refers to a microprocessor or microcontroller integrated within a larger system. In the case of the washing machine, the embedded system is dedicated to performing one specific task, which is controlling the programs for the washing cycle. It is an essential component of the washing machine, responsible for managing and executing the various washing programs. However, its functionality is limited to this specific task and does not encompass other functions within the washing machine.

**Full answer with explanations(b):** In the washing machine's embedded system:

RAM:

- RAM is used to store the choices or wash program selected by the user.
- It stores data read from the sensors, providing real-time information about the conditions of the washing process.
- RAM also holds information about the time left in the washing program, allowing the embedded system to track the progress of the cycle.

ROM:

- ROM is utilized to store the start-up instructions for the washing cycles.
- It contains the essential, non-changing instructions needed for initiating and executing the various washing programs.

**Full answer with explanations(c):** The system in the refrigerator is a control system rather than a monitoring system because:

- The system uses feedback: The microprocessor continuously monitors the temperature and utilizes feedback from this monitoring process to make real-time adjustments.
- The system causes the temperature to change and produces an action: In response to the feedback, the microprocessor takes active measures by turning on or off the cooling system to maintain the temperature within the desired range. It doesn't merely observe or monitor the temperature; it actively controls and influences the temperature by initiating actions based on the feedback it receives.

**6. Full answer with explanations(a):** Range (check)

**Full answer with explanations(b):** Presence (check)

**Full answer with explanations(c):** Existence (check)

**7. Full answer with explanations(a):** Bobby is incorrect in stating that a file-based approach is usually better than a relational database. The reasons include: Flat-file has more data redundancy: In a flat-file approach, the same data is stored multiple times, leading to redundancy. In a relational database, data is stored in different tables, and relationships are established between them, minimizing redundancy. Program-data dependence with flat-files: Flat-files are more dependent on the programs that access them. Any changes to the structure of the data require the programs to be rewritten to accommodate these changes, introducing inflexibility. Flat-file has more data inconsistency, worse data integrity: In a flat-file system, duplicated data might be stored differently, leading to data inconsistency. Additionally, when data is updated in one place, it may not be updated everywhere, compromising data integrity. Relational databases, with their normalization techniques and relational constraints, help maintain data consistency and integrity.

**Full answer with explanations(b)(i):** One-to-One:

- Example: Customer to Payment Details

- Explanation: Each customer has a unique set of payment details, and each set of payment details is associated with only one customer.

One-to-Many:

- Example: Customer to Order

- Explanation: A customer can place multiple orders, but each order is associated with only one customer.

Many-to-Many:

- Example: Order to Product

- Explanation: An order can consist of multiple products, and each product can be a part of multiple orders. This represents a many-to-many relationship between orders and products.

**Full answer with explanations(b)(ii):**

Relationship	Tick (✓)
one-to-one	
one-to-many	
many-to-many	✓

**Full answer with explanations(b)(ii):** CREATE DATABASE SHOPORDERS;

**Full answer with explanations(c):** In a data dictionary, three items that are stored include:

- Table Name: The names of the tables present in the database.
- Field Name/Attribute: The names of the fields or attributes within each table.
- Data Type: The data type associated with each field or attribute, indicating the kind of data that can be stored in that particular field (e.g., text, number, date).

**8. Full answer with explanations:**

Statement	AND	NAND	NOR	XOR	OR
The output is 1 only when both inputs are 1	✓				
The output is 1 only when both inputs are different				✓	
The output is 1 only when both inputs are 0			✓		