|  |  |  |  |
| --- | --- | --- | --- |
| **Q1** | **Q2** | **Q3** | **Total** |
| **20** | **14** | **36** | **70** |
|  |  |  |  |

**Question 1**

Which of the following statements is False and which is True: [**20 Marks**]

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Answer Question 1** | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  |  |  |  |  |  |  |  |  |  |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|  |  |  |  |  |  |  |  |  |  |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|  |  |  |  |  |  |  |  |  |  |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | |
|  |  |  |  |  |  |  |  |  |  | |

**Question 2: Multi choices Questions [14 MARKS]**

## …..

## ……

## …….

## ……………………….……

## . …………..……………………….……

## ……………………….……

## ……………………….……

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|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SOLUTION: Question 2** | | | | | | | | | | |
| ***a*** | ***b*** | ***c*** | ***d*** | ***e*** | ***f*** | ***g*** | ***h*** | ***i*** | ***j*** |
|  |  |  |  |  |  |  |  |  |  |
| ***k*** | ***l*** | ***m*** | ***n*** |
|  |  |  |  |

# **Question 3: [36 Marks]**

* 1. Draw the …………..

**[3 Marks]**

Draw the simplified block diagram of an MPEG video Compression

Diagram, schematic

Description automatically generated

3.2 If ………………………

)If the display order of the flowing video frames are I0, B-1, B0, B1, I1, B2, B3, B4, P2, B5, B6, P3, B7, B8, P4, B9, B10, I2. B11,B12, P5, show how the transmission order should be. [3 Marks]

Answer I0, I1, B-1, B0, B1, P2, B2, B3, B4, P3, B5, B6, P4, B7, B8, I2, B9, B10, P5, B11, B12

**3.3** **Explain ………………………..**

) **Explain** the basics of Standard JPEG base line Image Compression.

**Answer:**

Diagram

Description automatically generated

3.4 Apply ………………… algorithm to……………………………………. **[4 marks]**

**Apply** Dictionary based compression algorithm to compress (encode) the following symbols S4 S2 S3 S2 S3 S2 S1 S1 S2 S3 S2 S1 S2 assuming that the source alphabet consisting of 4 symbols. **[**3 Marks**]**

**Solution**

S4 S2 S3 S2 S3 S2 S1 S1 S2 S3 S2 S1 S2

The resulted code is:

4 2 3 6 2 1 1 7 10

|  |  |
| --- | --- |
| CODE | SYMBOL |
| 1 | S1 |
| 2 | S2 |
| 3 | S3 |
| 4 | S4 |
| 5 | S4S2 |
| 6 | S2S3 |
| 7 | S2 S3 S2 |
| 8 | S2S1 |
| 9 | S1S1 |
| 10 | S1 S2 |
| 11 | S2 S3 S2 S1 |
| 12 |  |
|  |  |

3.5 **[5 Marks]**

**1- Draw**.

**2- Find**

3- **Decompress**

**(a)** **Draw** Huffman tree  **[1 Marks]**

**(b)** **Find** Huffman Codes (code1)  **[2 Marks]**

**(c)** Assuming we used code 2 shown below:

Alphabet H G F E D C B A

Code2 000 001 100 010 111 110 101 011

**Find** average length of coded character when using code 1 and when using code 2. **[2 Marks]**

**Which** code (code1/code 2) is better in coding (compression) and decoding (decompression).

|  |  |
| --- | --- |
| 10 | A |
| 111 | B |
| 001 | C |
| 01 | D |
| 0001 | E |
| 1101 | F |
| 0000 | G |
| 1100 | H |

Code1 Average length = { 2 \*( 360+320) + 3\*(200+ 160)+4(80+100+40+90)} / 1350

= 2.726

Code2 Average length = 3

Code 1 is better in encoding

Code 2 is better in decoding (faster)

= 2.726

Code2 Average length = 3

Code 1 is better in encoding

Code 2 is better in decoding (faster)

**Diagram

Description automatically generatedSolution**

**3.6** Given the following ……………………..**Encode** ………………with the ……………… algorithm **[3 Marks]**

3.7 Assuming you have

Hand simulates the. …….

Assuming you have the DCT coefficient 40 proceeded by 50 zeros, and followed by 7 zeros and the DCT coefficient 30. Show how to apply sequential jpeg compression technique to do compression for the mentioned DCT coefficients. You can use the category table for AC coefficients shown below.  **[5 Marks]**Table

Description automatically generated Table

Description automatically generated

**Hand simulates** the coding process for the DCT coefficients.

**Answer:**

* Express AC coefficients Ai as *NNNNSSSS*

*NNNNSSSS= (*RUNLENGTH,CATGORY)

* Determine Vi the Huffman code corresponding to *NNNNSSSS*
  + - Runlength 16 : 11110000 *special code used for 16 zeros*

**First** coefficient 40 proceeded by 50 zeros

**(11110000) (11110000) (11110000) (2, 6) (40)** as CATGORY  *k* = 6

*NNNNSSSS= (*RUNLENGTH,CATGORY) = **(2, 6) = 0010 0110**

*Assuming the Huffman code corresponding to* **0010 0110** *is* ***1111***

*Gi = 1 as 40 is +ve*

*Determine relative magnitude of (40) =*  **0 1000**

*Encoding of Ai : Vi* ***.*** *Gi* ***.*** *Mi (* ***‘.’*** *: concatenation)‏ =* ***1111 . 1 .* 0 1000**

**First** coefficient 30 proceeded by 7 zeros

**(7, 5) (30)** as CATGORY  *k* = 5

*NNNNSSSS= (*RUNLENGTH,CATGORY) = **(7, 5) = 0111 0101**

*Assuming the Huffman code corresponding to* **0111 0101***is* ***1101***

*Gi = 1 as 30 is +ve*

*Determine relative magnitude of (30) =*  **1110**

*Encoding of Ai : Vi* ***.*** *Gi* ***.*** *Mi (* ***‘.’*** *: concatenation)‏ =* ***1101 . 1 .* 1110**

*3.***8 Explain** why [2 Marks]

3.9 **What** disadvantages of [2 Marks]

3.10 It is required to ………**What is** the …………………. [2 Marks]

(a) It is required to store a 24-bit true colour (with spatial resolution 1024 x 768)

uncompressed video of 3-hours duration on the hard disk. What is the storage size of

that video? How many CDs will be required? Given 1 KB = 1024 Byte, 1 MB = 1024

KB, CDs of capacity 700 MB each, frame rate 15 f/s. [2 Marks]

Answer:

Size of 1 frame = 1024 x 768 x 24 / 8 = 2359296 B

Size of 1 sec = 2359296 x 15 = 35389440 B

Size of 3 hours = 364500 MB

storage size = 364500 MB

Number of Cds = 521

(b) Assuming you applied sampling 4:1:1 and applying a compression technique with

(1:26) compression rate. What is the storage size of that video? How many such CDs

will be required? [2 Marks]

Answer:

Size of 1 frame = 1.5 x (1024 x 768 ) / 8 = 147456 B

Size of 1 sec = 2211840B =2.11 MB

Size for 3 Hours = 2.11 x 60 x 60 = 7593.75 MB

storage size = 7593.75 MB

Number of Cds = 11…

3.11 Assuming you applied…………. **What is** the…………….? [**2 Marks**]

3.12 What is ……….? Why is …………..? What is the beneﬁt of……………? [3 Marks]

**3.13** In ….., **Why** ……………………?  **[2** marks]

In MPEG, Why AC-coefficients of B and P frames are usually very large values, whereas those of I frame are very small? [2]

Answer: Because I frames are considered still images, whereas B and P frames store the differences between themselves and other frames. This makes I-frames more homogeneous than B and P frames. Therefore, after applying DCT, the differences between the waveform values and the mean of these values are smaller than those of B and P frames. In other words, AC coefficients which represent the differences between the waveform values and the DC coefficient (i.e. the mean) are smaller than those of B and P frames

* 1. It is required to …………………. **What is the …………………….**? Assuming you applied …………….. **What is the ……………………..**? [2 marks]

**3.15** Use the ……………….. purposes of ……………., **what** % percent compression ……………….. [2 marks]