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| **ASSIGNMENT** | |
| **Course Code** | CSC212A |
| **Course Name** | Data Communication |
| **Programme** | B. Tech. |
| **Department** | Computer Science and Engineering |
| **Faculty** | FET |

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| **Name of the Student** | ADITI SHARMA |
| **Reg. No** | 17ETCS002012 |
| **Semester/Year** | 04/2nd year |
| **Course Leader/s** | Dr. Rinki Sharma |

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| **Declaration Sheet** | | | | | | | | |
| Student Name | ADITI SHARMA | | | | | | | |
| Reg. No | 17ETCS002012 | | | | | | | |
| Programme | B. Tech | | | | | Semester/Year | 04/2nd year | |
| Course Code | CSC212A | | | | | | | |
| Course Title | Data Communication | | | | | | | |
| Course Date |  | | to | |  | | | |
| Course Leader | Dr. Rinki Sharma | | | | | | | |
| **Declaration**  The assignment submitted herewith is a result of my own investigations and that I have conformed to the guidelines against plagiarism as laid out in the Student Handbook. All sections of the text and results, which have been obtained from other sources, are fully referenced. I understand that cheating and plagiarism constitute a breach of University regulations and will be dealt with accordingly. | | | | | | | | |
| Signature of the Student | |  | | | | | Date |  |
| Submission date stamp  (by Examination & Assessment Section) | |  | | | | | | |
| Signature of the Course Leader and date | | | | Signature of the Reviewer and date | | | | |
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| **Faculty of Engineering & Technology** | | | | | | | | | | |  |
| **Ramaiah University of Applied Sciences** | | | | | | | | | | |  |
| **Department** | | | | Computer Science and Engineering | | **Programme** | B. Tech. | | | |  |
| **Semester/Batch** | | | | 4th/2017 | | | | | | |  |
| **Course Code** | | | | CSC212A | | **Course Title** | Data Communication | | | |  |
| **Course Leader** | | | | Dr. Rinki Sharma, Prof. A. Prabhakara | | | | | | |  |
| **Assignment no 1** | | | | | | | | | | |  |
| Name of Student | | |  | | Register No | | | |  | |  |
| Sections |  | Marking Scheme | | | | | | Max Marks | | First  Examiner  Marks | Second Examiner  M  arks |
| **Part**  **-**  **A** | A1.1 | Benefits and limitations of Source-Channel separation theorem | | | | | | 02 | |  |  |
| A1.2 | Significance and applications of Joint Source and Channel Coding (JSCC) | | | | | | 02 | |  |  |
| A1.3 | Conclusion | | | | | | 01 | |  |  |
|  | **Part-A Max Marks** | | | | | | **05** | |  |  |
| **Part**  **B 1** | B1.1 | Introduction | | | | | | 01 | |  |  |
| B1.2 | Algorithm / Flowchart for RLE computation | | | | | | 05 | |  |  |
| B1.3 | Computation of compressed value of considered data using RLE compression | | | | | | 03 | |  |  |
| B1.4 | Conclusion | | | | | | 01 | |  |  |
|  | **B.1 Max Marks** | | | | | | 10 | |  |  |
| **Part B 2** | B2.1 | Introduction | | | | | | 01 | |  |  |
| B2.2 | Implementation of RLE with explanation | | | | | | 04 | |  |  |
| B2.3 | Testing of RLE implementation and explanation of obtained output | | | | | | 04 | |  |  |
| B2.4 | Conclusion | | | | | | 01 | |  |  |
|  | **B.2 Max Marks** | | | | | | **10** | |  |  |
|  | **Total Assignment Marks** | | | | | | | **25** | |  |  |

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| **Subject Marks Tabulation** | | | | |
| **Component- CET B**  **Assignment** | **First**  **Examiner** | **Remarks** | **Second Examiner** | **Remarks** |
| A |  |  |  |  |
| B.1 |  |  |  |  |
| B.2 |  |  |  |  |
| B.3 |  |  |  |  |
| B.4 |  |  |  |  |
| **Marks (Max 50 )** |  |  |  |  |
| **Marks (out of 25 )** |  |  |  |  |
| Signature of First Examiner Signature of Second Examiner | | | | |

# Please note:

1. Documental evidence for all the components/parts of the assessment such as the reports, photographs, laboratory exam / tool tests are required to be attached to the assignment report in a proper order.
2. The First Examiner is required to mark the comments in RED ink and the Second Examiner’s comments should be in GREEN ink.
3. The marks for all the questions of the assignment have to be written only in the **Component – CET B: Assignment** table.
4. If the variation between the marks awarded by the first examiner and the second examiner lies within +/- 3 marks, then the marks allotted by the first examiner is considered to be final. If the variation is more than +/- 3 marks then both the examiners should resolve the issue in consultation with the Chairman BoE.

# PART A 5 Marks

# Preamble

Shannon’s separation theorem states that source coding and channel coding can be performed separately and sequentially. This theorem has been used for years for information encoding. However, researchers have observed that Joint Source and Channel Coding tends to perform better for real-time data transmission over noisy channels. In this context, develop an essay on **“Joint Source and Channel Coding (JSCC)”**

Your essay should comprise the following:

**A1.1** Benefits and limitations of Source-Channel separation theorem :

It is currently time to join the outcomes from the discrete source coding theorem

furthermore, the channel capacity theorem. The discrete source coding theorem states

that the information Xn can be compressed to utilize subjectively near H∞(X) bits per

coded source symbol and the channel capacity theorem expresses that subjectively close

to C bits per channel use can be dependably transmitted over a given channel. Knowing these different outcomes the inquiry regarding how to design the encoder/decoder

in a system which needs to do both source and channel coding

emerges. Since the discrete source coding theorem just relies upon the statistical

properties of the source and the channel coding theorem just relies upon the statistical properties of the channel one may expect that a different design of source

furthermore, channel codes is comparable to some other strategy. Things being what they are, for stationary

sources a source– channel code exist when H∞(X) < C with the end goal that

the error probability amid transmission can be made subjective little. The converse, H∞(X) > C, infers that the error probability is limited far from zero

what's more, it is beyond the realm of imagination to expect to accomplish self-assertive little error probability. The situation when

H∞(X) = C is left unsolved and will rely upon the source insights just as

the channel properties.

For non stationary sources the source– channel partition coding theorem takes

an other shape and we have to utilize ideas like "entirely commanding" and "control."

In view of these hypothetical outcomes it might show up as though source and channel codes

could be designed independently. Notwithstanding, this is just valid under the presumptions

legitimate when inferring the outcomes in and . One of these presumptions is the

utilization of boundlessly long codes, for example n → ∞. By and by this isn't possible, particularly when managing ongoing applications like video gushing or VoIP.

Source and channel coders are generally actualized successively and autonomously dependent on Shannon's outstanding partition hypothesis. Be that as it may, handy correspondence systems are compelled by intricacy and inertness. Subsequently, the partition coding guideline does not hold even hypothetically in some down to earth correspondence systems. Going for the constraint of the Shannon partition hypothesis in useful applications, numerous scientists have concentrated on the investigation of joint source-channel coding/decoding (JSCC/JSCD) systems. Through mutually enhanced source and channel parameters, they have accomplished a critical number of essential outcomes for ideal transmission execution.

**A1.2** Significance and applications of JSCC :

As of now, JSCC/JSCD methods are testing research subjects, with extraordinary hypothetical essentialness and application prospects. On the encoder side, the channel coder is constrained by the source hugeness data (SSI) from the source coder, which enhances the general encoding proficiency through joint source-channel coding. On the decoder side, the channel decoder uses the source an earlier data (SAI) from the encoder side and the channel state data (CSI) acquired from the channel estimator, to do the joint source-channel decoding. Through the dreary and iterative estimation and modification of the decoder dependability data (DRI) and the a data (API) between the channel decoder and the source decoder, a base joint decoding error proportion is accomplished. Existing joint source-channel streamlined design can be isolated into three classes.

The first is "Joint source-channel coding (JSCC)", which more often than not centers around the streamlined design of source coding and channel coding on the encoder side.

The second is "Joint source-channel decoding (JSCD)". It uses an earlier data (SAI) for bit-level encoding/decoding, which is predominantly for settled length encoding (FLC, for example, codebook-energized straight expectation (CELP). The benefit of the FLC lies in its basic usage and low multifaceted nature. Be that as it may, the pressure isn't as proficient.

The third is "Variable-length JSCC with variable-length JSCD". In light of the joint trellis, a symbol-level a post probability (APP) decoding calculation is additionally determined, which prompts a joint iterative decoding approach with symbol-level delicate yields. The exploratory outcomes demonstrate that the joint source-channel encoding/decoding plan has gotten preferred execution over existing joint iterative decoding dependent on the bit-level super trellis.

**A1.3** Conclusion  **:**

The gathering purpose of the two primary parts of the Shannon hypothesis is the joint source-channel coding theorem. This theorem has two sections: an immediate part and a converse part. It pursues that either dependable transmission is conceivable by isolated source-channel coding or it is absurd in any way. This is the motivation behind why the joint source-channel coding theorem is regularly alluded to as the partition theorem. We portray those channels for which the established explanation of the partition theorem holds for each source. We likewise portray those sources for which the partition theorem holds for each channel. An end to be drawn from our outcomes is that when managing non stationary probabilistic models, care ought to be practiced before applying the division theorem.

# PART B 20 Marks

# B1 10 Marks

Run Length Encoding (RLE) is a lossless data compression technique which runs on sequences having same value occurring consecutive times. You need to consider a data sequence comprising of at least 50 characters with certain characters occurring consecutively. Compute the compressed value using RLE compression. Develop an algorithm / flowchart for RLE implementation.

Document the following:

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|  |  | **B1.1** | Introduction :  Run-length encoding (RLE) is a basic type of lossless data compression in which runs of data are put away as a single data value and count, as opposed to as the first run. This is most helpful on data that contains numerous such runs. Consider, for instance, basic graphic pictures, for example, icons. It isn't helpful with files that don't have numerous runs as it could enormously build the file size. |
|  |  | **B1.2** | Algorithm / Flowchart for RLE computation :  STEP 1: START  STEP 2: Pick the first character from source string. STEP 3: Append the picked character to the destination string. STEP 4: Count the number of subsequent occurrences of the picked character and append the count to destination string. STEP 5: Pick the next character and repeat steps 1) 2) and 3) if end of string is NOT reached.  STEP 6: END |
|  |  | **B1.3** | Computation of compressed value of considered data using RLE compression :  I am taking “aabbbccccdddddffffffggggggghhhhhhhhiiiiiiiiijjjjjj” as my string.  So,  Compressed value of considered data using RLE = a2b3c4d5f6g7h8i9j6 |
|  |  |  |  |
|  |  | **B1.4** | Conclusion :  This algorithm is extremely simple to actualize and does not require much CPU horsepower. RLE compression is just productive with files that contain loads of repetitive data. These can be text files in the event that they contain loads of spaces for indenting however line-art images that contain expansive white or dark territories are unquestionably progressively appropriate. Computer-generated shading images can likewise give reasonable compression proportions. |
| **B.** |  | 2. | **10 Marks** |
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Develop a program to achieve data compression using RLE. Test the working of the program with data considered in Part B1. The answer should comprise of the following:

Document the following:

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|  |  | **B2.1** | Introduction :  In the program we are entering the string in the program itself and not asking user for the string. The program will read each letter and calculate how many times it has recurred in a row until the end has reached. In the output it will display the letter and number of times it has occurred along with it. |
|  |  | **B2.2** | Implementation of RLE with explanation :  C:\Users\DELL\Desktop\Assignment 1\c4.PNG |
|  |  | **B2.3** | Testing of RLE implementation and explanation of obtained output  C:\Users\DELL\Desktop\Assignment 1\c2.PNG  C:\Users\DELL\Desktop\Assignment 1\c3.PNG  If we look closely and verify ,we can see that the displayed output “a2b3c4d5f6g7h8i9j6” is the required result we were hoping for .  a has occurred two times in a row.  b has occurred three times in a row .  c has occurred four times in a row .  d has occurred five times in a row .  f has occurred six times in a row .  g has occurred seven times in a row .  h has occurred eight times in a row .  i has occurred nine times in a row .  j has occurred six times in a row .  Exactly what the input was given. |
|  |  | **B2.4** | Conclusion **:**  **Run Length Encoding can be utilized to encode any sort of data without misfortune, yet it's helpful with just a particular kind of data which includes a decent lot of repetition, in some different cases it can even be costly to utilize and could cost a greater number of bytes than the original data.** |