Unit 9 - Week 1: Assignments

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Join the 5G Revolution in India

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Week 2: Decoding LDPC Codes

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Assignment 1

The due date for submitting this assignment has passed. **Due on 2019-02-13, 23:59 IST.**
As per our records you have not submitted this assignment.

1) Consider a linear block code with the parity check matrix $\begin{bmatrix} 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 \end{bmatrix}$ .The number of edges in the corresponding Tanner Graph is _____ .

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 8

1 point

2) Consider a linear block code with the parity check matrix $\begin{bmatrix} 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{bmatrix}$. The maximum bit node degree in the corresponding tanner graph is _____.

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 3

1 point

3) If the expansion factor of a base matrix is 20, then the maximum value of an entry in the base matrix is _____ .

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 19

1 point

4) Consider a protograph LDPC code with a base matrix of dimension 42 × 52. Let the expansion factor be 12. Then, the number of message bits in any codeword of this code is _____ .

Interaction session

The number of 1s in a parity check matrix given by the base matrix $\begin{bmatrix} 0 & -1 & 4 & 0 & -1 & -1 \\ 4 & 2 & -1 & 1 & 0 & -1 \\ 1 & -1 & 3 & 2 & -1 & 0 \end{bmatrix}$ with expansion factor 5 is _____.

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 55

1 point

6) The number of -1s in the E part of a 46 x 68 base matrix in the 5G standard is _____.

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 7

1 point

7) Consider a protograph LDPC code with an expansion factor of 6. The vector $\begin{bmatrix} 1 & 1 & 0 & 1 & 0 & 0 \end{bmatrix}$ acted on by the base matrix entry 2 will transform to: ***1 point***

- [1 0 1 0 0 1]
- [0 1 1 0 1 0]
- [0 1 0 0 1 1]
- [0 0 1 1 0 1]

No, the answer is incorrect.
Score: 0

Accepted Answers:
[0 1 0 0 1 1]

8) Consider a protograph LDPC code with expansion factor 6. Say that two vectors p_1 and q_1 are related as $q_1 = I_2 p_1$. Then, which of the following relations must also hold true: ***1 point***

- $p_1 = Iq_1$
- $p_1 = I_4 q_1$
- $p_1 = I_3 q_1$
- $p_1 = I_2 q_1$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$p_1 = I_4 q_1$

9) You are encoding a protograph LDPC code with expansion factor 5 and the following base matrix,(the notation is same as that used in the lectures) ***1 point***

$$\begin{bmatrix} I_1 & 0 & I_3 & I_1 & I_2 & I & 0 & 0 \\ I_2 & I & 0 & I_3 & I_2 & I & I & 0 \\ 0 & I_4 & I_2 & I & I_1 & 0 & I & 0 \\ I_4 & I_1 & I & 0 & 0 & 0 & 0 & I \end{bmatrix}$$

Let the codeword be represented by $\begin{bmatrix} m_1 & m_2 & m_3 & m_4 & p_1 & p_2 & p_3 & p_4 \end{bmatrix}$, where $m_i's$ are the message blocks and $p_i's$ are the parity blocks. Given that you are first computing p_1 given a particular message $\begin{bmatrix} m_1 & m_2 & m_3 & m_4 \end{bmatrix}$, the equation you need to solve is:

- $I_1 p_1 = I_1 m_1 + I_2 m_1 + I_4 m_1 + I m_2 + I_4 m_2 + I_1 m_2 + I_3 m_3 + I_2 m_3 + I m_3 + I_1 m_4 + I_3 m_4 + I m_4$
- $I_1 p_1 = I_1 m_1 + I_2 m_1 + I m_2 + I_4 m_2 + I_3 m_3 + I_2 m_3 + I_1 m_4 + I_3 m_4 + I m_4$

$I_1p_1 = I_4m_2 + I_2m_3 + Im_4 + Ip_3$

$Ip_1 = I_4m_1 + I_1m_2 + Im_3$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$I_1p_1 = I_1m_1 + I_2m_1 + Im_2 + I_4m_2 + I_3m_3 + I_2m_3 + I_1m_4 + I_3m_4 + Im_4$

10)Consider the 42 x 52 base matrix in the 5G standard for the expansion factor 384. Any codeword in this code consists of 52 blocks with each block having 384 bits. Let $[m_1, m_2, m_3, m_4, \ldots, m_{10}, p_1, p_2, p_3, \ldots p_{42}]$ denote a codeword belonging to this code where $m_1, m_2, m_3, m_4, \ldots, m_{10}$ are the message blocks and $p_1, p_2, p_3, \ldots p_{42}$ are the parity blocks. In encoding $[m_1, m_2, m_3, \ldots, m_{10}]$ to $[m_1, m_2, m_3, \ldots, m_{10}, p_1, p_2, p_3, \ldots p_{42}]$, the sufficient information to compute p_9 is *1 p*

$m_1, m_2, m_3, m_4, \ldots, m_{10}, p_1, p_2, p_3, \ldots, p_8$

$m_1, m_2, m_3, m_4, \ldots, m_{10}, p_1, p_3, p_5, p_7$

$m_1, m_2, m_3, m_4, \ldots, m_{10}, p_1, p_2, p_3, p_4$

$m_1, m_2, m_3, m_4, \ldots, m_{10}, p_2, p_4, p_6, p_8$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$m_1, m_2, m_3, m_4, \ldots, m_{10}, p_1, p_2, p_3, p_4$

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