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Courses » LDPC and Polar Codes in 5G Standard

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Unit 12 - Week 2 Assignments

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Course outline

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Week 2: Decoding
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Week 2
Assignments

☐ Quiz : Assignment
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Assignment 2

The due date for submitting this assignment has passed.

As per our records you have not submitted this assignment.

Due on 2019-02-25, 23:59 IST

1) Consider a coded-BPSK transmission over an AWGN channel using the $(5, 1)$ repetition code. Assume **1 point** that $2/\sigma^2 = 1$. If the received symbol vector is $[-1.5 \ 0.2 \ 2.0 \ -0.8 \ -0.1]$, then the LLRs input to and output from the SISO decoder for the third bit are



$-2.2, 0.2$



$2.0, -0.2$



$0.2, -2.2$



$-0.2, 2.0$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$2.0, -0.2$

2) Consider a coded-BPSK transmission over an AWGN channel using the $(5, 4)$ single parity check code. **1 point** If the received symbol vector is $[-1.5 \ 0.2 \ 2.0 \ -0.8 \ -0.3]$, then the belief vector put out by the minsum SISO decoder is



$[-1.7 \ 0.5 \ 2.2 \ -1.0 \ -0.5]$



$[-1.3 \ -0.1 \ 1.8 \ -0.6 \ -0.1]$



$[0.2 \ -0.3 \ -0.2 \ 0.2 \ 0.2]$



$[-0.2 \ 0.3 \ 0.2 \ -0.2 \ -0.2]$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$[-1.3 \ -0.1 \ 1.8 \ -0.6 \ -0.1]$

3) Consider the minsum soft-in-soft-out(SISO) decoder for a $(5, 4)$ single parity check code. If the **1 point** received symbol vector over a BPSK-AWGN channel is $[-1.8 \ 0.2 \ 1.2 \ -0.2 \ -0.5]$, then the belief vector put out by the minsum SISO decoder is

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Assignment 02
Solutions

Week 3

Week 3
Assignments

Week 4

Week 4 Assignment

VIDEO DOWNLOAD

Interaction session

Develop

$[-1.6 \quad 0.0 \quad 1.0 \quad 0.0 \quad -0.3]$

$[0.2 \quad -0.5 \quad -0.2 \quad 0.2 \quad 0.2]$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$[-1.6 \quad 0.0 \quad 1.0 \quad 0.0 \quad -0.3]$

4) Suppose we use the minsum SISO iterative message passing decoder to decode symbol vectors received over a BPSK-AWGN channel from the $(6, 3)$ code with parity-check matrix $\begin{bmatrix} 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 \end{bmatrix}$. Let $l_{i \rightarrow j}$ denote the message passed by bit node i to check node j and let $l'_{j \rightarrow i}$ denote the message passed by check node j to bit node i . If the received symbol vector is $[-0.5 \quad 1.2 \quad -2.0 \quad 0.2 \quad -0.8 \quad 1.5]$, then

$l'_{3 \rightarrow 1}$ in the first iteration = _____

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) -1.5

0.5 points

5) $l_{1 \rightarrow 3}$ in the second iteration = _____

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) -0.3

0.5 points

6) Consider an NR-LDPC code with base matrix of dimension 42×52 and expansion-factor $z = 384$. The first two message blocks are punctured. Assume that your message consists of only 8×384 bits, and that you are allowed to transmit 40×384 bits. Then, the number of parity bits that need to be punctured is = _____

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Numeric) 3072

1 point

7) Consider an NR-LDPC code with base matrix of dimension 46×68 and expansion-factor $z = 48$. The first two message blocks are punctured. The last 60 message bits have been shortened, and the last 100 parity bits have been punctured. Then, the rate of the code is



$\frac{46}{68}$



$\frac{996}{3104}$



$\frac{996}{3008}$



$\frac{900}{3104}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

 $\frac{996}{3008}$

For questions 8 to 13: Consider a coded-BPSK transmission over an AWGN channel using a (9,3) code with parity check matrix specified by the base matrix $\begin{bmatrix} 2 & 1 & 0 \\ 0 & 1 & 2 \end{bmatrix}$ with expansion factor 3. Let the received symbol vector be $r = [0.85 \quad -0.85 \quad 0.61 \quad -0.55 \quad 0.43 \quad -1.53 \quad -1.40 \quad -0.47 \quad -0.28]$.

In questions 8 to 10, consider decoding r using the minsum SISO iterative message passing decoder. Let L be the storage matrix.

8) The contents of the fifth row of L on which the row operation will be performed in the first and second iterations are respectively **1 point**

☐ $[\times \quad 0.61 \quad \times \quad \times \quad \times \quad 0.43 \quad -1.40 \quad \times \quad \times], [\times \quad 1.08 \quad \times \quad \times \quad \times \quad 0.15 \quad -0.55 \quad \times \quad \times]$
☐ $[\times \quad -0.85 \quad \times \quad \times \quad \times \quad -1.53 \quad -1.40 \quad \times \quad \times], [\times \quad -1.25 \quad \times \quad \times \quad \times \quad 1.5 \quad 0.75 \quad \times \quad \times]$
☐ $[\times \quad \times \quad 0.61 \quad -0.55 \quad \times \quad \times \quad \times \quad -0.47 \quad \times], [\times \quad \times \quad 0.18 \quad -0.27 \quad \times \quad \times \quad \times \quad -1.32 \quad \times]$
☐ $[\times \quad -0.85 \quad \times \quad \times \quad \times \quad -1.53 \quad -1.40 \quad \times \quad \times], [\times \quad -0.57 \quad \times \quad \times \quad \times \quad -2 \quad -0.97 \quad \times \quad \times]$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$[\times \quad -0.85 \quad \times \quad \times \quad \times \quad -1.53 \quad -1.40 \quad \times \quad \times], [\times \quad -0.57 \quad \times \quad \times \quad \times \quad -2 \quad -0.97 \quad \times \quad \times]$

9) The contents of the third row of L on which the row operation will be performed in the second and third iterations are respectively **1 point**

☐ $[\times \quad \times \quad 1.08 \quad \times \quad 0.15 \quad \times \quad -0.55 \quad \times \quad \times], [\times \quad \times \quad 0.88 \quad \times \quad 0.70 \quad \times \quad -0.83 \quad \times \quad \times]$
☐ $[\times \quad 0.55 \quad \times \quad -1.02 \quad \times \quad \times \quad \times \quad \times \quad 0.15], [\times \quad 0.12 \quad \times \quad -0.73 \quad \times \quad \times \quad \times \quad \times \quad -0.4]$
☐ $[\times \quad -0.57 \quad \times \quad \times \quad \times \quad -2 \quad -0.97 \quad \times \quad \times], [\times \quad -1 \quad \times \quad \times \quad \times \quad -2.1 \quad -1.25 \quad \times \quad \times]$
☐ $[\times \quad -1.6 \quad \times \quad 1.25 \quad \times \quad \times \quad \times \quad \times \quad -2.15], [\times \quad -0.12 \quad \times \quad +0.73 \quad \times \quad \times \quad \times \quad \times \quad 0]$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$[\times \quad 0.55 \quad \times \quad -1.02 \quad \times \quad \times \quad \times \quad \times \quad 0.15], [\times \quad 0.12 \quad \times \quad -0.73 \quad \times \quad \times \quad \times \quad \times \quad -0.4]$

10) The decoded message at the end of second iteration is **1 point**

☐ $[1 \quad 0 \quad 1]$
☐ $[1 \quad 1 \quad 1]$
☐ $[0 \quad 0 \quad 0]$
☐ $[0 \quad 1 \quad 0]$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$[0 \quad 1 \quad 0]$

In questions 11 to 13 consider decoding r using the layered-minsum SISO iterative message passing decoder with each block row of the given base matrix as one layer. Let L be the storage matrix.

11) The contents of the fifth row of L on which the row operation will be performed in the first iteration are **1 point**

- ☐ $\begin{bmatrix} \times & -0.85 & \times & \times & \times & -1.53 & -1.40 & \times & \times \end{bmatrix}$
- ☐ $\begin{bmatrix} \times & -0.57 & \times & \times & \times & -2 & -0.97 & \times & \times \end{bmatrix}$
- ☐ $\begin{bmatrix} \times & -0.85 & \times & \times & \times & -0.55 & -0.28 & \times & \times \end{bmatrix}$
- ☐ $\begin{bmatrix} \times & 0.55 & \times & \times & \times & -1.02 & 0.15 & \times & \times \end{bmatrix}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\begin{bmatrix} \times & -0.57 & \times & \times & \times & -2 & -0.97 & \times & \times \end{bmatrix}$

12) The contents of the third row of L on which the row operation will be performed in the second iteration are **1 point**

- ☐ $\begin{bmatrix} \times & 0.12 & \times & -0.73 & \times & \times & \times & \times & -0.46 \end{bmatrix}$
- ☐ $\begin{bmatrix} \times & 0.55 & \times & -1.02 & \times & \times & \times & \times & 0.15 \end{bmatrix}$
- ☐ $\begin{bmatrix} \times & -0.85 & \times & -0.55 & \times & \times & \times & \times & -0.28 \end{bmatrix}$
- ☐ $\begin{bmatrix} \times & -1 & \times & -2.1 & \times & \times & \times & \times & -1.25 \end{bmatrix}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\begin{bmatrix} \times & 0.12 & \times & -0.73 & \times & \times & \times & \times & -0.46 \end{bmatrix}$

13) The decoded message at the end of second iteration is

1 point

- ☐ $\begin{bmatrix} 1 & 0 & 1 \end{bmatrix}$
- ☐ $\begin{bmatrix} 0 & 0 & 0 \end{bmatrix}$
- ☐ $\begin{bmatrix} 1 & 1 & 1 \end{bmatrix}$
- ☐ $\begin{bmatrix} 0 & 1 & 0 \end{bmatrix}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\begin{bmatrix} 0 & 0 & 0 \end{bmatrix}$

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