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Courses » LDPC and Polar Codes in 5G Standard

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Unit 16 - Week 4 Assignment

Register for Certification exam

Course outline

- How to access the portal
- Matlab access and Learning Modules
- Week 0 : Introduction to Error Correction Codes
- Week 0 : Linear Binary Block Codes
- Week 0 : Assignment
- Join the 5G Revolution in India
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Assignment 4

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-03-10, 23:59 IST.

1) Consider that you have received the vector $r = [-3.2, 2.6]$ .The maximum value allowed in the decoder is 4, and 6 bits are used to represent the finite precision values. Then, the received vector used by the finite precision decoder is: ***1 point***

- $[-25, 20]$
- $[-24, 20]$
- $[-3, 3]$
- $[-3, 2]$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$[-25, 20]$

2) Consider a (512,256) polar code with successive cancellation list decoding. The number of CRC bits used for each codeword is 12. Then, the rate of the code is ***1 point***

- 1/2
- 67/131
- 64/125
- 61/128

No, the answer is incorrect.
Score: 0

Accepted Answers:

- $PM_2 < PM_1$, and both $u^{(1)}$ and $u^{(2)}$ satisfied the CRC.
- $PM_2 < PM_1$, and $u^{(2)}$ satisfied the CRC but $u^{(1)}$ did not.
- $PM_1 \leq PM_2$, and $u^{(2)}$ satisfied the CRC but $u^{(1)}$ did not.
- $PM_1 \leq PM_2$, and both $u^{(1)}$ and $u^{(2)}$ did not satisfy CRC.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$PM_1 \leq PM_2$, *and* $u^{(2)}$ *satisfied the CRC but* $u^{(1)}$ *did not.*

Use the following information for questions 4 to 9: Say a received vector from a coded-BPSK transmission using an (N,K) polar code over an AWGN channel, is being decoded using the successive cancellation list decoder with a list size of 4. Then, the binary tree representation of the code has a depth $n = \log_2 N$. Consider a node x at depth $n - 1$. Let y and z be its left and right child respectively. During the decoding process, the list of belief vectors received by x from its parent are: $L_1 = [3, -5]$, $L_2 = [1, 4]$, $L_3 = [-4, -2]$ and $L_4 = [-3, 1]$. The corresponding path metrics are $PM_1 = 12$, $PM_2 = 14$, $PM_3 = 16$ and $PM_4 = 18$. Remember that the path metrics are always arranged in ascending order.

4) If the node y is frozen, then the updated belief vectors and the corresponding path metrics after the node y has been processed is: ***1 point***

- $L_1 = [3, -5]$, $L_2 = [1, 4]$, $L_3 = [-4, -2]$ and $L_4 = [-3, 1]$; $PM_1 = 14$, $PM_2 = 15$, $PM_3 = 16$ and $PM_4 = 19$
- $L_1 = [1, 4]$, $L_2 = [3, -5]$, $L_3 = [-4, -2]$ and $L_4 = [-3, 1]$; $PM_1 = 14$, $PM_2 = 15$, $PM_3 = 16$ and $PM_4 = 19$
- $L_1 = [3, -5]$, $L_2 = [1, 4]$, $L_3 = [-4, -2]$ and $L_4 = [-3, 1]$; $PM_1 = 12$, $PM_2 = 14$, $PM_3 = 16$ and $PM_4 = 18$
- $L_1 = [3, -5]$, $L_2 = [1, 4]$, $L_3 = [-4, -2]$ and $L_4 = [-3, 1]$; $PM_1 = 12$, $PM_2 = 15$, $PM_3 = 17$ and $PM_4 = 18$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$L_1 = [1, 4]$, $L_2 = [3, -5]$, $L_3 = [-4, -2]$ *and* $L_4 = [-3, 1]$; $PM_1 = 14$, $PM_2 = 15$, $PM_3 = 16$ *and* $PM_4 = 19$

5) (Assuming node y is frozen) If the node z corresponds to a message bit, then the updated path metrics after the node z has been processed is ***1 point***

- $PM_1 = 14$, $PM_2 = 15$, $PM_3 = 16$ and $PM_4 = 19$
- $PM_1 = 14$, $PM_2 = 15$, $PM_3 = 16$ and $PM_4 = 21$

$PM_1 = 14, PM_2 = 15, PM_3 = 16$ and $PM_4 = 17$

$PM_1 = 14, PM_2 = 15, PM_3 = 21$ and $PM_4 = 22$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$PM_1 = 14, PM_2 = 15, PM_3 = 16$ *and* $PM_4 = 17$

6) (Assuming node y is frozen) If node z corresponds to a message bit, then the list of hard-decision vectors (corresponding to the ascending order of path metrics) that x sends to its pare is: ***1 po***

$u^{(1)} = [0,0], u^{(2)} = [1,1], u^{(3)} = [1,1]$ and $u^{(4)} = [0,0]$

$u^{(1)} = [1,1], u^{(2)} = [0,0], u^{(3)} = [0,0]$ and $u^{(4)} = [1,1]$

$u^{(1)} = [0,1], u^{(2)} = [1,0], u^{(3)} = [0,1]$ and $u^{(4)} = [1,0]$

$u^{(1)} = [1,0], u^{(2)} = [1,0], u^{(3)} = [0,1]$ and $u^{(4)} = [0,1]$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$u^{(1)} = [0,0], u^{(2)} = [1,1], u^{(3)} = [1,1]$ *and* $u^{(4)} = [0,0]$

7) If the node y corresponds to a message bit, then the updated path metrics after the node y ***1 point*** has been processed is

$PM_1 = 12, PM_2 = 14, PM_3 = 15$ and $PM_4 = 16$

$PM_1 = 12, PM_2 = 14, PM_3 = 15$ and $PM_4 = 15$

$PM_1 = 14, PM_2 = 15, PM_3 = 16$ and $PM_4 = 16$

$PM_1 = 12, PM_2 = 14, PM_3 = 16$ and $PM_4 = 16$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$PM_1 = 12, PM_2 = 14, PM_3 = 15$ *and* $PM_4 = 15$

8) (Assuming node y corresponds to a message bit) If the node z is frozen, then the updated path metrics after the node z has been processed is ***1 point***

$PM_1 = 14, PM_2 = 15, PM_3 = 17$ and $PM_4 = 21$

$PM_1 = 14, PM_2 = 15, PM_3 = 17$ and $PM_4 = 17$

$PM_1 = 14, PM_2 = 15, PM_3 = 21$ and $PM_4 = 22$

$PM_1 = 14, PM_2 = 15, PM_3 = 17$ and $PM_4 = 20$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$PM_1 = 14$, $PM_2 = 15$, $PM_3 = 17$ *and* $PM_4 = 20$

9) Let the list of belief vectors received by node x from its parent be: $L_1 = [2, 4]$, $L_2 = [-4, 5]$, $L_3 = [3, 2]$ and $L_4 = [1, 2]$ and let the corresponding path metrics be $PM_1 = 4$, $PM_2 = 7$, $PM_3 = 10$ and $PM_4 = 13$. If both y and z correspond to message bits, then the list of hard-decision vectors(corresponding to the ascending order of path metrics) that x sends to its parent is: **1 point**

- $u^{(1)} = [0, 0]$, $u^{(2)} = [1, 0]$, $u^{(3)} = [1, 0]$ and $u^{(4)} = [1, 1]$
- $u^{(1)} = [0, 0]$, $u^{(2)} = [1, 0]$, $u^{(3)} = [1, 0]$ and $u^{(4)} = [0, 1]$
- $u^{(1)} = [0, 1]$, $u^{(2)} = [1, 0]$, $u^{(3)} = [0, 1]$ and $u^{(4)} = [1, 0]$
- $u^{(1)} = [1, 0]$, $u^{(2)} = [1, 0]$, $u^{(3)} = [0, 1]$ and $u^{(4)} = [0, 1]$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$u^{(1)} = [0, 0]$, $u^{(2)} = [1, 0]$, $u^{(3)} = [1, 0]$ *and* $u^{(4)} = [0, 1]$

10) Consider decoding a received vector from a coded-BPSK transmission using the $(32, 20)$ Polar code over an AWGN channel, with the successive cancellation list decoder. If the list size is 4, the codeword bit position (numbered from 1 to N) at which the fourth decoder gets activated is _____.(Use the same reliability sequence as mentioned in class).

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 12

1 point

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