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# Unit 5 - Week-4

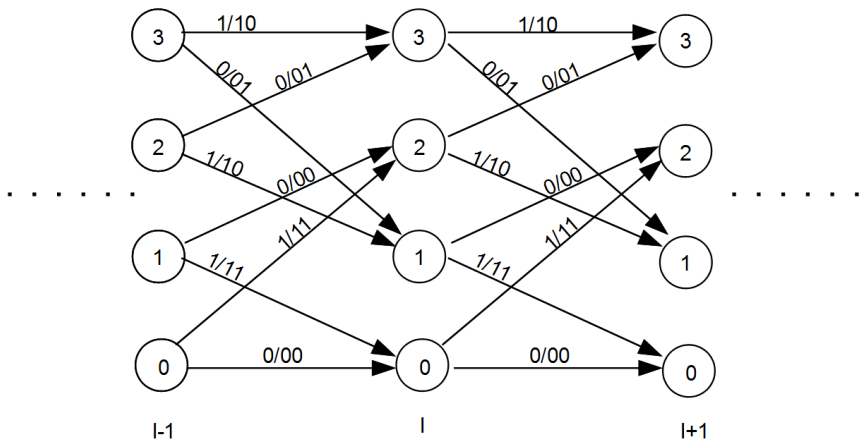


## Assignment-4

**The due date for submitting this assignment has passed.** **Due on 2016-04-12, 23:55 IST.**

**Submitted assignment**

1) Given below is a trellis diagram of (2,1,2) convolutional encoder. What is the correct expression for forward recursion, alpha calculation? All the notations are same as used in the lectures. ***1 point***




- $\alpha_l(0) = \gamma_{l-1}(0,0) * \alpha_{l-1}(0) + \gamma_{l-1}(1,0) * \alpha_{l-1}(1)$
- $\alpha_l(0) = \gamma_{l-1}(0,2) * \alpha_{l-1}(2) + \gamma_{l-1}(0,0) * \alpha_{l-1}(0)$
- $\alpha_l(0) = max^*(\gamma_{l-1}(0,2) * \alpha_{l-1}(2), \gamma_{l-1}(0,0) * \alpha_{l-1}(0))$
- None of the above

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$\alpha_l(0) = \gamma_{l-1}(0,0) * \alpha_{l-1}(0) + \gamma_{l-1}(1,0) * \alpha_{l-1}(1)$

2) For the same encoder given in previous question, what is the correct expression for beta calculation? All the notations are same as used in the lectures. ***1 point***

- $\beta_l(0) = \gamma_l(0,1) * \beta_{l+1}(1) + \gamma_l(0,0) * \beta_{l+1}(0)$
- $\beta_l(0) = \gamma_l(0,2) * \beta_{l+1}(2) + \gamma_l(0,0) * \beta_{l+1}(0)$
- $\beta_l(0) = max^*(\gamma_l(0,1) * \beta_{l+1}(1), \gamma_l(0,0) * \beta_{l+1}(0))$

None of the above

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$\beta_l(0) = \gamma_l(0,2) * \beta_{l+1}(2) + \gamma_l(0,0) * \beta_{l+1}(0)$

3) What is the value of $max^*(0.3, 0.5, 0.6)$? All the notations are same as used in the lectures. ***1 point***

- 0.6
- 1.1
- 1.4
- 1.6

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*1.6*

4) A tail-biting convolutional encoder has the same initial state as the final state. For a tail biting (n,1,m) convolutional encoder, what are the correct initial values for forward recursion ? All the notations are same as used in the lectures. ***1 point***

- $\alpha_0(s) = \frac{1}{2^m}$ for all states
- $\alpha_0(s) = \frac{1}{m}$ for all states
- $\alpha_0(s) = \begin{cases} 1 & \text{if } s = 0 \\ 0 & \text{otherwise} \end{cases}$
- None of the above

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$\alpha_0(s) = \frac{1}{2^m}$ *for all states*

5) For a tail-biting (n,1,m) convolutional encoder of length N, what are the initial values for backward recursion ? All the notations are same as used in the lectures. ***1 point***

- $\beta_N(s) = \frac{1}{2^m}$ for all states
- $\beta_N(s) = \frac{1}{m}$ for all states
- $\beta_N(s) = \begin{cases} 1 & \text{if } s = 0 \\ 0 & \text{otherwise} \end{cases}$
- None of the above

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$\beta_N(s) = \frac{1}{2^m}$ *for all states*

6) For a rate $R = \frac{1}{3}$ turbo code, what is the correct expression for computation of extrinsic information at the output of decoder 1? All the notations are same as used in the lectures. ***1 point***

- $L^{(1)}(u_l)$
- $L^1(u_l) - L_c r_l^{(0)}$

$L^{(1)}(u_l) - L_c r_l^{(0)} - L_c r_l^{(1)}$

$L^{(1)}(u_l) - L_c r_l^{(0)} - L_a{}^{(1)}(u_l)$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$L^{(1)}(u_l) - L_c r_l^{(0)} - L_a{}^{(1)}(u_l)$

7) Which of the following statements is incorrect about measures of convergence for turbo codes? ***1 point***

- tenBrink's EXIT chart is based on mutual information.
- Measure of convergence accurately predicts the performance of small to moderate block length turbo codes in the waterfall region.
- Divsalar's density evolution method is based on tracking the actual density of extrinsic and a-priori information.
- Convergence threshold of rate R=1/2 turbo codes is more than 0 dB (Shannon capacity limit).

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Measure of convergence accurately predicts the performance of small to moderate block length turbo cod in the waterfall region.*

8) For a (2,1,3) convolutional encoder, which of the following is feasible value for $d_{free}$? ***1 point***

- $\infty$
- 8
- 7
- 6

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*6*

9) Which of the following statement is incorrect? ***1 point***

- GSM standard uses convolutional code for error control coding.
- Convolutional coding is mandatory for WiMAX standard.
- Galileo deep space mission to Jupiter used convolutional coding and BCJR decoding.
- Trellis coded modulation that combines coding with modulation found its application in analog telephone modems.

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Galileo deep space mission to Jupiter used convolutional coding and BCJR decoding.*

10) For reliable communication in presence of Gaussian noise, what is the minimum signal to noise ratio $E_b/N_0$ required if we are using a rate $R = 4/5$ code? ***1 point***

- 2.35 dB
- 1.0368 dB
- $\infty$
- 0 dB

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*1.0368 dB*

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