

9. (2 points) The input bits to a BSC(p) follow the Bernoulli($q = 0.5$) distribution. Suppose the output of the BSC is $Y = 1$. In this case, (a) what is the posterior likelihood ratio in favor of $X = 1$? (b) what is the probability of bit detection error at the receiver when the receiver uses the ML detection?
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10. (2 points) Define a new logarithmic function (not the standard logarithmic function which is in decibel scale) of SNR λ such that, when $\lambda \gg 1$, the SNR at the output of your logarithmic function becomes *equal* to the spectral efficiency η_B in bps/Hz.
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11. (1 points) The SNR per symbol and the SNR per bit are related as $E_S/N_0 = \alpha \times E_b/N_0$. Here $\alpha =$:
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12. (1 points) A power value in the decibel scale of 30 dBm equals how many watts?
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2 Multiple Choice Questions:

Instructions

- ▷ This is MCQ Answer Key of IV.
- ▷ There are total 20 questions in this section that carry a maximum of 32 marks.
- ▷ Tick mark the correct option.
 - Total marks for a correctly answered question are indicated for each question. If the question is answered incorrectly, negative marking will apply, with negative one-fourth of the total marks awarded to a wrong answer.
 - If more than one option is tick-marked, zero marks will be given for the question even if one of the tick-marked options is correct.

Questions

Version	I	II	III	IV
Question 1				
Answer (a):	-0.25 pts	1 pt	-0.25 pts	1 pt
Answer (b):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (c):	-0.25 pts	-0.25 pts	1 pt	-0.25 pts
Answer (d):	1 pt	-0.25 pts	-0.25 pts	-0.25 pts
Answer (e):	—	—	-0.25 pts	—
Question 2				
Answer (a):	1 pt	-0.25 pts	-0.25 pts	-0.25 pts

Version	I	II	III	IV
Answer (b):	-0.25 pts	-0.25 pts	1 pt	-0.25 pts
Answer (c):	-0.25 pts	1 pt	-0.25 pts	1 pt
Answer (d):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (e):	—	-0.25 pts	—	—
Question 3				
Answer (a):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (b):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (c):	1 pt	1 pt	-0.25 pts	-0.25 pts
Answer (d):	-0.25 pts	-0.25 pts	1 pt	1 pt
Answer (e):	—	—	—	-0.25 pts
Question 4				
Answer (a):	-0.25 pts	1 pt	-0.25 pts	-0.25 pts
Answer (b):	-0.25 pts	-0.25 pts	-0.25 pts	1 pt
Answer (c):	1 pt	-0.25 pts	-0.25 pts	-0.25 pts
Answer (d):	-0.25 pts	-0.25 pts	1 pt	-0.25 pts
Question 5				
Answer (a):	1 pt	-0.25 pts	1 pt	-0.25 pts
Answer (b):	-0.25 pts	-0.25 pts	-0.25 pts	1 pt
Answer (c):	-0.25 pts	1 pt	-0.25 pts	-0.25 pts
Answer (d):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Question 6				
Answer (a):	-0.25 pts	-0.25 pts	0.25 pts	-0.25 pts
Answer (b):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (c):	-0.25 pts	-0.25 pts	-0.25 pts	1 pt
Answer (d):	-0.25 pts	1 pt	1 pt	-0.25 pts
Answer (e):	1 pt	—	—	—
Question 7				
Answer (a):	-0.25 pts	1 pt	-0.25 pts	-0.25 pts
Answer (b):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (c):	1 pt	-0.25 pts	1 pt	-0.25 pts
Answer (d):	-0.25 pts	-0.25 pts	-0.25 pts	1 pt
Question 8				
Answer (a):	1 pt	1 pt	-0.25 pts	-0.25 pts
Answer (b):	-0.25 pts	-0.25 pts	1 pt	1 pt
Answer (c):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (d):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Question 9				
Answer (a):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (b):	1 pt	-0.25 pts	-0.25 pts	1 pt
Answer (c):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (d):	-0.25 pts	1 pt	1 pt	-0.25 pts
Question 10				
Answer (a):	-0.25 pts	-0.25 pts	-0.25 pts	1 pt
Answer (b):	-0.25 pts	1 pt	-0.25 pts	-0.25 pts
Answer (c):	1 pt	-0.25 pts	-0.25 pts	-0.25 pts
Answer (d):	-0.25 pts	-0.25 pts	1 pt	-0.25 pts
Answer (e):	—	—	—	-0.25 pts
Question 11				
Answer (a):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (b):	-0.25 pts	-0.25 pts	1 pt	-0.25 pts
Answer (c):	1 pt	1 pt	-0.25 pts	1 pt

Version	I	II	III	IV
Answer (d):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Question 12				
Answer (a):	1 pt	1 pt	-0.25 pts	-0.25 pts
Answer (b):	-0.25 pts	-0.25 pts	1 pt	-0.25 pts
Answer (c):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (d):	-0.25 pts	-0.25 pts	-0.25 pts	1 pt
Question 13				
Answer (a):	-0.25 pts	1 pt	1 pt	1 pt
Answer (b):	1 pt	-0.25 pts	-0.25 pts	-0.25 pts
Answer (c):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (d):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Question 14				
Answer (a):	1 pt	0.25 pts	1 pt	1 pt
Answer (b):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (c):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (d):	-0.25 pts	1 pt	-0.25 pts	-0.25 pts
Question 15				
Answer (a):	-0.25 pts	1 pt	-0.25 pts	-0.25 pts
Answer (b):	-0.25 pts	-0.25 pts	-0.25 pts	1 pt
Answer (c):	-0.25 pts	-0.25 pts	1 pt	-0.25 pts
Answer (d):	1 pt	-0.25 pts	-0.25 pts	-0.25 pts
Question 16				
Answer (a):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (b):	-0.25 pts	1 pt	-0.25 pts	-0.25 pts
Answer (c):	-0.25 pts	-0.25 pts	-0.25 pts	1 pt
Answer (d):	1 pt	-0.25 pts	1 pt	-0.25 pts
Question 17				
Answer (a):	1 pt	-0.25 pts	-0.25 pts	1 pt
Answer (b):	0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (c):	-0.25 pts	-0.25 pts	1 pt	-0.25 pts
Answer (d):	-0.25 pts	1 pt	-0.25 pts	-0.25 pts
Answer (e):	—	-0.25 pts	—	—
Question 18				
Answer (a):	1 pt	1 pt	-0.25 pts	-0.25 pts
Answer (b):	-0.25 pts	-0.25 pts	1 pt	0.25 pts
Answer (c):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (d):	-0.25 pts	-0.25 pts	-0.25 pts	1 pt
Question 19				
Answer (a):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (b):	1 pt	1 pt	-0.25 pts	-0.25 pts
Answer (c):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (d):	-0.25 pts	-0.25 pts	1 pt	1 pt
Answer (e):	—	—	-0.25 pts	—
Question 20				
Answer (a):	-0.25 pts	1 pt	-0.25 pts	1 pt
Answer (b):	1 pt	-0.25 pts	1 pt	-0.25 pts
Answer (c):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (d):	-0.25 pts	-0.25 pts	-0.25 pts	-0.25 pts
Answer (e):	-0.25 pts	—	—	—