

ELE 533 - Multiuser Detection

Fall 2004

Problem 3.43

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Solution

Let $x = A/\sigma$, then we only need to show that for sufficiently small x ,

$$Q(x) > \frac{1}{2} \left(1 - \frac{1}{\sqrt{1+x^{-2}}} \right) \quad (1)$$

By (3.54) in textbook, we have

$$Q(x) = \frac{1}{2} - \frac{1}{\sqrt{2\pi}}x + o(x) \quad (2)$$

The Taylor expansion of the right hand side of (1) at $x = 0$ is

$$\frac{1}{2} \left(1 - \frac{1}{\sqrt{1+x^{-2}}} \right) = \frac{1}{2} - \frac{1}{2}x + o(x) \quad (3)$$

Compare (2) and (3). Since $x > 0$, it is easy to see that for sufficiently small x , we have (1).