

# Statistical signal processing (5CTA0)

## Written exam

5 November 2018, 13.30 - 16.30

The TU/e central exam regulations apply to this exam.

During this exam, you are allowed to use a short own made summary (maximum 1 A4 front and back) and a scientific calculator. This exam consist of 4 exercises. The first exercise is composed of 4 multiple choice questions, while exercises 2, 3, and 4 are open questions. An answer sheet is provided to write down your answers. For exercise 1, provide only the correct answer in the answer sheet. For exercise 2, 3, and 4, provide a short explanation (only the necessary steps) and the final answer. Only the answer sheets are collected at the end of the exam. The point assigned to each subquestions are given on the right margin. The total number of points sums up to 10.

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### Exercise 1

- (a) A random variable  $X$  is defined by the following probability mass function (PMF) (0.5 pt.)

$$p_X(x) = \begin{cases} \frac{1}{4} & x=1,2,3,4 \\ 0 & \text{elsewhere} \end{cases}$$

If  $Y = 10.5X - 0.5X^2$ , what is the expected value of  $Y$ ?

- A.  $E[Y] = 22.5$
- B.  $E[Y] = 20$
- C.  $E[Y] = 45.5$
- D.  $E[Y] = 15$

- (b) Which of the following statements is false? (0.5 pt.)

- A. Two independent random variables are also uncorrelated.
- B. Two independent random variables are also uncorrelated only if they are jointly Gaussian.
- C. For uncorrelated random variables  $E[x_1(k)x_2(k)] = E[x_1(k)]E[x_2(k)] = \mu_1\mu_2$ .
- D. For independent random variables  $E[x_1(k)x_2(k)] = E[x_1(k)]E[x_2(k)] = \mu_1\mu_2$ .

- (c) In the context of Wiener filtering, which of the following statements is true? (0.5 pt.)

- A. In a filtering application, increasing the filter order of the optimum FIR filter always leads to lower MSE.
- B. The Wiener filter is designed to maximize the signal-to-noise ratio.
- C. In a deconvolution application, the lowest MSE for the optimum FIR filter is obtained when the delay is approximately equal to filter order.
- D. For the one-step causal IIR linear predictor, the prediction error is white.

# Multiple Choice Biomedical Signal Processing Final Exam

**JR Anderson**



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## **Table of Contents Multiple Choice Biomedical Signal Processing Final Exam**

1. Understanding the eBook Multiple Choice Biomedical Signal Processing Final Exam
  - The Rise of Digital Reading Multiple Choice Biomedical Signal Processing Final Exam
  - Advantages of eBooks Over Traditional Books
2. Identifying Multiple Choice Biomedical Signal Processing Final Exam
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Multiple Choice Biomedical Signal Processing Final Exam
  - User-Friendly Interface
4. Exploring eBook Recommendations from Multiple Choice Biomedical Signal Processing Final Exam
  - Personalized Recommendations
  - Multiple Choice Biomedical Signal Processing Final Exam User Reviews and Ratings
  - Multiple Choice Biomedical Signal Processing Final Exam and Bestseller Lists
5. Accessing Multiple Choice Biomedical Signal Processing Final Exam Free and Paid eBooks
  - Multiple Choice Biomedical Signal Processing Final Exam Public Domain eBooks
  - Multiple Choice Biomedical Signal Processing Final Exam eBook Subscription Services
  - Multiple Choice Biomedical Signal Processing Final Exam Budget-Friendly Options
6. Navigating Multiple Choice Biomedical Signal Processing Final Exam eBook Formats

- ePub, PDF, MOBI, and More
- Multiple Choice Biomedical Signal Processing Final Exam Compatibility with Devices
- Multiple Choice Biomedical Signal Processing Final Exam Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Multiple Choice Biomedical Signal Processing Final Exam
  - Highlighting and Note-Taking Multiple Choice Biomedical Signal Processing Final Exam
  - Interactive Elements Multiple Choice Biomedical Signal Processing Final Exam
- 8. Staying Engaged with Multiple Choice Biomedical Signal Processing Final Exam
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Multiple Choice Biomedical Signal Processing Final Exam
- 9. Balancing eBooks and Physical Books Multiple Choice Biomedical Signal Processing Final Exam
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Multiple Choice Biomedical Signal Processing Final Exam
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Multiple Choice Biomedical Signal Processing Final Exam
  - Setting Reading Goals Multiple Choice Biomedical Signal Processing Final Exam
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Multiple Choice Biomedical Signal Processing Final Exam
  - Fact-Checking eBook Content of Multiple Choice Biomedical Signal Processing Final Exam
  - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
- 14. Embracing eBook Trends
  - Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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