Arizona State University (ASU) BME100 Introduction to Biomedical Engineering Midterm Practice Exam (Sample)

Study Guide

Everything you need from our exam experts!

Questions

1. What does the null hypothesis state?

   A. There is a strong correlation between two variables

   B. There is no relationship between two variables

   C. There is a positive outcome from a treatment

   D. Variables have a significant effect on each other

2. How many prescriptions are written per year in the US?

   A. 2 billion

   B. 3 billion

   C. 4 billion

   D. 5 billion

3. What is a common use of polymers in biomedical applications?

   A. Bone plate

   B. Dialysis machine

   C. Artificial skin

   D. Pacemaker

4. How many trillion cells does the human body contain?

   A. 25

   B. 30

   C. 37

   D. 40

5. What does "Freedom to Operate" typically require in terms of legal precautions?

   A. Innovation assessment

   B. Search Firm analysis

   C. Marketability research

   D. Regulatory approval

6. Inferential statistics allow researchers to:

A. Summarize findings efficiently

B. Test hypotheses and make comparisons

C. Focus solely on variants

D. Report data without inference

7. What physiological change accompanies increased neuronal activity in an fMRI scan?

A. Decreased blood flow

B. Increased oxygen consumption

C. Increased blood flow

D. Stable blood flow

8. Approximately how many different types of neurotransmitters exist?

A. 50

B. 75

C. 100

D. 150

9. How long did the recipient of the first lung transplant survive?

A. 5 days

B. 10 days

C. 18 days

D. 20 days

10. What symbol is frequently used to denote the mean in statistics?

A. M

B. x

C. x bar

D. μ

Answers

1. B
2. C
3. C
4. C
5. B
6. B
7. C
8. C
9. C
10. C

Explanations

1. What does the null hypothesis state?

A. There is a strong correlation between two variables

B. There is no relationship between two variables

C. There is a positive outcome from a treatment

D. Variables have a significant effect on each other

The null hypothesis posits that there is no relationship or effect between two variables. This foundational concept in statistics serves as a default position that suggests any observed differences or relationships in the data can be attributed to chance rather than a true effect. In hypothesis testing, researchers typically aim to either reject the null hypothesis or fail to reject it based on the evidence collected from their experiments or observations. By assuming the null hypothesis at the start, researchers can then use statistical methods to assess whether the data provides sufficient evidence to support an alternative hypothesis, which usually suggests that there is a significant effect or relationship present. Other choices imply a presence of a relationship or an effect, which contradicts the null hypothesis's core assertion. For example, claiming there is a strong correlation, a positive outcome from a treatment, or that variables significantly affect one another all infer that some kind of relationship exists, thus making those assertions incompatible with the fundamental premise of the null hypothesis.

2. How many prescriptions are written per year in the US?

A. 2 billion

B. 3 billion

C. 4 billion

D. 5 billion

The correct answer reflects the estimated number of prescriptions written annually in the United States. According to various healthcare statistics, the figure is indeed close to 4 billion prescriptions each year. This number encompasses all prescription medications dispensed, including both chronic medications and those for acute conditions. The data supports this estimate as it aligns with trends in the increasing number of healthcare providers, the aging population, and the rise in the prevalence of chronic diseases that require ongoing management through medication. Understanding this figure is essential for students in biomedical engineering as it emphasizes the significant impact and demand for pharmaceuticals in healthcare, which can lead to innovations in drug delivery systems, medication adherence technologies, and ultimately improve patient care.

3. What is a common use of polymers in biomedical applications?

A. Bone plate

B. Dialysis machine

C. Artificial skin

D. Pacemaker

Polymers are widely utilized in biomedical applications due to their versatility, biocompatibility, and ability to be tailored for various functions. In particular, artificial skin is a notable application of polymers. This typically involves using polymeric materials that can mimic the properties of human skin, providing a protective barrier as well as facilitating regeneration and healing. The use of polymers in artificial skin allows for flexible, durable, and often biocompatible materials that can support cell growth and integrate with natural tissues. These polymeric scaffolds can also be designed to release growth factors or drugs, enhancing the healing process. In contrast, while bone plates, dialysis machines, and pacemakers have important biomedical uses, they often rely on different materials and technologies. Bone plates are usually made from metal or composite materials for strength, dialysis machines involve complex systems typically composed of various materials for filtration, and pacemakers mainly utilize metals and electronic components rather than polymers as their primary material. Therefore, the specific use of polymers in the context of artificial skin exemplifies their valuable role in biomedical engineering.

4. How many trillion cells does the human body contain?

A. 25

B. 30

C. 37

D. 40

The human body is estimated to contain approximately 37 trillion cells. This figure represents a comprehensive approximation that considers the various types of cells present in different tissues and organs, including muscle cells, nerve cells, red blood cells, and many others. Understanding the sheer number of cells helps highlight the complexity of the human body and the incredible processes occurring within it, which are essential for maintaining health and function. The estimate of 37 trillion cells illustrates the incredible diversity and specialization of cells necessary for complex life processes. Such knowledge is crucial in biomedical engineering, as it aids in understanding how various interventions, treatments, and technologies can impact the body at a cellular level. This precise number reinforces the importance of cell biology in fields like tissue engineering, regenerative medicine, and other aspects of biomedical research.

5. What does "Freedom to Operate" typically require in terms of legal precautions?

A. Innovation assessment

B. Search Firm analysis

C. Marketability research

D. Regulatory approval

"Freedom to Operate" refers to the ability to commercialize a product without infringing on the intellectual property rights of others. This concept is crucial in industries like biomedical engineering where patents and proprietary technologies are prevalent. The correct answer involves conducting a search firm analysis, which plays a vital role in identifying existing patents and intellectual property that could pose a risk to new innovations. This analysis helps determine whether a company can bring a product to market without violating any rights. By systematically analyzing existing patents related to their technology, organizations can assess their freedom to operate and make informed decisions about product development or licensing. In contrast, while the other options such as innovation assessment, marketability research, and regulatory approval are important aspects of the product development lifecycle, they do not specifically address the legal considerations required to ensure that a product can be developed and sold without infringing on the rights of others. Each of these areas has its own focus—whether it's evaluating the novelty of an idea, understanding market demand, or ensuring compliance with governmental regulations—but none encapsulates the legal scrutiny needed to confirm freedom to operate like a search firm analysis does.

6. Inferential statistics allow researchers to:

A. Summarize findings efficiently

B. Test hypotheses and make comparisons

C. Focus solely on variants

D. Report data without inference

Inferential statistics play a crucial role in research as they enable researchers to test hypotheses and make comparisons between different groups or conditions. This type of statistical analysis allows for the drawing of conclusions about a population based on sample data. Researchers can apply inferential statistics to determine whether observed differences between groups are statistically significant or if these differences might have occurred by chance. By utilizing methods such as t-tests, ANOVA, and regression analysis, researchers can assess relationships and effects while accounting for variability. This process is essential in establishing the validity of theories and understanding the underlying patterns within the data. Therefore, the ability to test hypotheses and make comparisons is central to the role of inferential statistics in the scientific method, as it aids in validating research findings and contributing to the broader knowledge base in the field.

7. What physiological change accompanies increased neuronal activity in an fMRI scan?

A. Decreased blood flow

B. Increased oxygen consumption

C. Increased blood flow

D. Stable blood flow

The correct answer is associated with the phenomenon known as neurovascular coupling, which describes how an increase in neuronal activity leads to a corresponding increase in blood flow to the active regions of the brain. When neurons become more active, they require more oxygen and nutrients to sustain that activity. To meet this demand, local blood flow increases, which is detected during functional MRI (fMRI) scans. This increase in blood flow enriches the area with oxygenated blood, allowing the neurons to function more effectively. In fMRI, this is measured through the Blood Oxygen Level Dependent (BOLD) signal, which reflects changes in blood flow and oxygenation levels in the brain. This response is critical for understanding brain function and is the basis for using fMRI as a tool to map brain activity during various tasks or stimuli. Thus, the correct response highlights the essential relationship between neuronal activity and hemodynamic responses, which is fundamental in the study of brain functions using neuroimaging techniques like fMRI.

8. Approximately how many different types of neurotransmitters exist?

A. 50

B. 75

C. 100

D. 150

The correct response highlights that there are approximately 100 different types of neurotransmitters identified in the human body. Neurotransmitters are crucial chemical messengers that facilitate communication between neurons, and they play essential roles in transmitting signals across synapses. The vast array of neurotransmitters includes well-known examples such as dopamine, serotonin, and acetylcholine, each with unique functions and effects on mood, movement, and various physiological processes. The count of about 100 encompasses both classical neurotransmitters, which act quickly and are often released in response to electrical signals, and neuropeptides, which can influence a variety of bodily functions and are involved in slower, more prolonged signaling. Understanding the diversity of neurotransmitters is crucial in the study of neurobiology and biomedical engineering, particularly when designing therapies targeting specific neurological conditions. This number reflects the complexity and adaptability of the nervous system, accommodating various functions essential for survival and well-being.

9. How long did the recipient of the first lung transplant survive?

A. 5 days

B. 10 days

C. 18 days

D. 20 days

The recipient of the first successful lung transplant survived for 18 days, which is reflected in the correct answer. This transplantation was a significant milestone in the field of medicine, marking a pioneering effort to extend life through organ transplantation. Although the recipient ultimately succumbed to complications, this case paved the way for advancements in surgical techniques, immunosuppression protocols, and post-operative care, greatly influencing subsequent lung transplant procedures and long-term outcomes. The knowledge gained from this initial surgery established foundational practices that have improved the survival rates of lung transplant recipients in later years.

10. What symbol is frequently used to denote the mean in statistics?

A. M

B. x

C. x bar

D. μ

The symbol frequently used to denote the mean in statistics is commonly represented as "x bar." This notation specifically indicates the average value of a set of data points. It is derived from the letter "x," which represents a variable or a single data point in a dataset, with a bar placed over it to signify that we are referring to the arithmetic mean or average of those data points. Using "x bar" helps distinguish the average from the individual data points, making it clear that we are talking about a statistical summary of the data rather than a specific observation. In contexts where the population mean is addressed, the Greek letter "μ" might also be used, but "x bar" remains the most commonly recognized symbol for the sample mean in a broader array of statistical applications, especially in introductory courses. This clarity is essential in statistics, as it ensures that when discussing data use and analysis, the terminology is precise, allowing for effective interpretation and communication of statistical findings.