

Sample Question Paper

Entrance Test for PhD Program at KCDH

General Instructions:

- I. Write your name, email, registration/application number and phone number below
 - II. This question paper consists of two parts: Part A and Part B. Both parts are **COMPULSORY**.
 - III. Duration of the test is 2 hours and for a total of 40 marks.
 - IV. Non programmable calculators are allowed.
 - V. The test is computer based and will be conducted remotely using CodeTantra proctoring.
 - a. Please be ready to login to CodeTantra a few minutes before the specified time.
 - b. You will be allowed to take the test only when your video, audio, and screen share is available and the proctor is satisfied that you are not using any other device (such as a phone), and do not have anything on your table other than a single notebook and pen.
 - c. You are **not** allowed to use any notes (printed or electronic material).
 - d. You are **not** allowed to use earphones
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Total Time: 2 hours

Maximum Marks: 40

Please fill details below:

1. Name:
2. Email:
3. Registration/Application number:
4. Phone number:

Part A

Instructions:

- I. Attempt any 10 Objective type questions
 - II. Every question is of 1 mark.
 - III. You can attempt any number of questions from a particular domain.
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1. Which one of the following leukocytes are present in the largest proportion in healthy human blood?

[Bio]

- A. Basophiles B. Eosinophils C. Neutrophils D. Monocytes

Answer: C

2. Which of the following is not a type/rhythm of EEG signal? **[Bio]**

- A. Delta B. Theta C. Alpha D. Zeta

Answer: D

3. Which of the following is one of the international healthcare standards? **[Healthcare/Medical]**

- (A) HC7 (B) HL7 (C) HCS (D) HLS

Answer: B

4. Which of the following statement(s) is/are true about India's health care spending since 2000?

[Healthcare/Medical]

- A. Government spending as % of healthcare spending has been decreasing, but out-of-pocket spending as % of healthcare spending has remained stable
B. Government spending as % of healthcare spending has been increasing, but out-of-pocket spending as % of healthcare spending has been decreasing
C. Government spending as % of healthcare spending has been increasing and out-of-pocket spending as % of healthcare spending has been increasing
D. Government spending as % of healthcare spending has been decreasing, but out-of-pocket spending as % of healthcare spending has been increasing

Answer: B

5. Which of the following characteristics of the healthcare market are deviations from that of the competitive market? **[Healthcare/Medical]**

- A. Pricing of medical products
B. Freedom of entry into the healthcare market
C. Homogeneous quality of health care services
D. Nature of demand for medical care

Answer: A, B, C, D

6. Which of the following seeks to measure the benefits to individuals of additional life years following medical interventions? **[Healthcare/Medical]**

- A. Cost minimization
B. Cost-utility analysis
C. Quality adjusted life years
D. Profit maximization

Answer: B

7. Children with no insurance received healthcare through a program called what?

[Healthcare/Medical]

- A. Medical
- B. Social security program
- C. Maternal and child health bureau
- D. State Children's Health Insurance Program (SCHIP)

Answer: D

8. If on a group of 457 patients, for a risk factor we calculated an Odds Ratio OR= 12.74, the possibility of developing the disease being investigated is: **[Statistics/Biostatistics/epidemiology]**

- A. very high when exposed to the factor
- B. very small when exposed to the factor (protective factor)
- C. the same in the case of exposure in the case of non-exposure
- D. lower in the exposed than in the unexposed, OR being less than 100

Answer: B

9. The Sensitivity (SN) of a clinical trial **[Statistics/Biostatistics/epidemiology]**

- A. is the ratio of sick patients, diagnosed as positive, and the total number of sick patients.
- B. is the ratio of healthy subjects, diagnosed as negative, and the total number of healthy subjects
- C. is the ratio of sick patients, diagnosed as negative, and the total number of patients.
- D. is the ratio of sick patients, diagnosed as negative, and the total number of healthy persons

Answer: A

10. If you flip a coin 40 times and get heads every time. What is the likelihood of flipping a tails the 41st time? **[Statistics/Biostatistics/epidemiology]**

- A. 1/41
- B. 40/41
- C. $\frac{1}{2}$
- D. 1

Answer: D

11. Which of the following is TRUE with respect to the term "random chance?"

[Statistics/Biostatistics/epidemiology]

- A. Outcomes of clinical trials may be affected by random chance
- B. Statistical tests help to determine the effect of random chance on the study outcomes
- C. Random chance is also known as "systematic variation"
- D. A and B
- E. All of the above

Answer: A & B

12. A study is conducted to determine the effect of Vitamin C tablets on mortality. After the study is completed, the data indicate that patients taking Vitamin C tablets had a decrease in mortality. However, the study design did not control for the effects of dietary Vitamin C. Which of the following terms best describes the role of DIETARY Vitamin C in this study? [Biostatistics/epidemiology]

- A. Independent variable
- B. Dependent variable
- C. Confounding variable
- D. Control variable
- E. None of the above

Answer: C

13. The type-II hypersensitivity reaction is mainly mediated by [Bio]

- A. IgE
- B. IgM
- C. IgA
- D T cells

Answer: B

14. Allergies are due to a hyper immune response. Drugs given to counter allergies target [Bio]

- A. Glycine
- B. Histamine
- C. Insulin
- D. Cellulose

Answer: B

15. Consider the following three functions. [Computer Science]

$$f_1 = 10^n, f_2 = n^{\log n}, f_3 = n^{\sqrt{n}}$$

Which one of the following options arrange the functions in the increasing order of asymptotic growth rate?

- A. f_3, f_2, f_1
- B. f_2, f_1, f_3
- C. f_1, f_2, f_3
- D. f_2, f_3, f_1

Answer: D

16. Consider the following Boolean expression $F = (X + Y + Z)(\bar{X} + Y)(\bar{Y} + Z)$. [Computer Science]

Which of the following Boolean expressions is/are equivalent to \bar{F} (compliment of F)?

- A. $(\bar{X} + \bar{Y} + \bar{Z})(X + \bar{Y})(Y + \bar{Z})$

- B. $X\bar{Y} + \bar{Z}$
- C. $(X + \bar{Z})(\bar{Y} + \bar{Z})$
- D. $X\bar{Y} + Y\bar{Z} + \bar{X}\bar{Y}\bar{Z}$

Answer: B,C,D

17. Given below are two statements 1 and 2, and two conclusions I and II. [Computer Science]

Statement 1: All bacteria are microorganisms.

Statement 2: All pathogens are microorganisms.

Conclusion I: Some pathogens are bacteria.

Conclusion II: All pathogens are not bacteria.

Based on the above statements and conclusions, which one of the following options is logically CORRECT?

- A. Only conclusion I is correct
- B. Only conclusion II is correct
- C. Either conclusion I or II is correct
- D. Neither conclusion I nor II is correct.

Answer: C

18. A certain processor uses a fully associative cache of size 16 kB. The cache block size is 16 bytes. Assume that the main memory is byte addressable and uses a 32-bit address. How many bits are required for the Tag and the Index fields respectively in the addresses generated by the processor? [Computer Science]

- A. 24 bits and 0 bits
- B. 28 bits and 4 bits
- C. 24 bits and 4 bits
- D. 28 bits and 0 bits

Answer: D

19. Which of the following cannot be considered a software component? [Computer Science]

- A. Database
- B. File
- C. RAM
- D. Code

Answer: C RAM (random access memory) is a hardware, not software.

20. Python uses a hybrid approach of compiling and interpreting. [Computer Science]

- A. True
- B. False

Answer: A

Part A Ends here

Part B

Instructions

- I. Answer any TEN questions. Only the first TEN questions that you attempt will be evaluated.
 - II. Each question carries 3 marks.
 - III. Give precise answers and write clearly.
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1. Comment on the following statement: "Allocative efficiency and production/technical efficiency refer to one and the same thing since every point on the production possibilities frontier represents both allocative and production/technical efficiency."
2. Comment on the features of the healthcare market which distinguishes itself from the market for other goods and services in terms of: (i) uncertainty, and (ii) externalities.
3. What is the difference between actuarially fair vs. actuarially unfair insurance?
4. What is the Data life cycle in healthcare?
5. Explain the clinical significance of different components of a normal ECG signal.
6. What are the different phases of clinical trials?
7. We assume that blood pressure, X , has a $N(\mu, \sigma^2)$ distribution. To estimate μ and σ , we randomly sampled 9 people and measured their blood pressure. The sample mean and sample standard deviation are $\bar{X} = 110$ and $S = 6$. Knowing that based on the $t(8)$ distribution, 0.8-quantile = 0.9, 0.85-quantile = 1.1, 0.9-quantile = 1.4, and 0.95-quantile = 1.9, answer the following questions. Then calculate the point estimate for μ along with its standard error.
8. A cancer with poor prognosis, a three-year mortality of 85%, is studied. A new mode of chemotherapy is to be evaluated. Suppose that when testing at the 0.10 significance level, one wishes to be 95% certain of detecting a difference if survival has been increased to 50% or more. The randomized clinical trial will have equal numbers of people in each group. How many patients should be randomized?
9. Let $\{X_n\}_{n \geq 1}$ be a sequence of independent and identically distributed normal random variables with mean 4 and variance 1. Then $\lim_{n \rightarrow \infty} P\left(\sum_{i=1}^n X_i > 4.0006\right)$ is equal to _____.
10. Consider a computer system with 40-bit virtual addressing and page size of sixteen kilobytes. If the computer system has a one-level page table per process and each page table entry requires 48 bits, then the size of the per-process page table is _____ megabytes.
11. Let T be a full binary tree with 8 leaves. (A full binary tree has every level full.) Suppose two leaves a and b of T are chosen uniformly and independently at random. The

expected value of the distance between a and b in T (i.e., the number of edges in the unique path between a and b) is (rounded off to 2 decimal places)_____ .

12. The cache memory unit with capacity of N words and block size of B words are to be designed. If it is designed as a direct mapped cache, the length of the TAG field is 10 bits. If the cache unit is now designed as a 16-way set-associative cache, the length of the TAG field is _____ bits.
13. Explain the difference between compilation and interpretation of a computer program.
14. Explain when one would use a spreadsheet for data storage and when one would use a database?
15. Consider the grammar defined by the following production rules, with two operators $*$ and $+$
 - $A \rightarrow B * S$
 - $B \rightarrow V \mid B * V$
 - $S \rightarrow T + S \mid T$
 - $T \rightarrow \text{Id}$
 - $V \rightarrow \text{Id}$

Then, is the following statement true +? "**Both + and * are left associative**". Provide justification for the same while correcting the statement if required.

Part B ends here
