ПЕРЕЧЕНЬ ЭКЗАМЕНАЦИОННЫХ ВОПРОСОВ

Направление 01.04.02 Прикладная математика и информатика
Магистерская программа «Биоинформатика и системная биология» Кафедра компьютерных технологий

Mathematics

1. Prime and composite numbers. Divisibility. Infinitude of primes. The fundamental theorem of arithmetics. Greatest common denominator and lowest common multiple.
2. Degree with a rational exponent. Exponent function. Logarithm. Its definition and properties.
3. Trigonometric functions. Their definitions and properties.Vector and scalar product in two-dimensional and three-dimensional space.
4. The principle of mathematical induction. Bernoulli inequality. Arithmetical and geometrical progressions, general term formula and sum formula.
5. Polynomials in one variable. Vieta's formulas. The number of roots of a polynomial.

Recommended reading:

1) https://www.khanacademy.org/math

Programming in Python

1. Python Interpreter. Using Python interactively. Running Python programs.
2. Numbers. Operations with integers. Operations with real numbers. Comparison operations
3. Strings. Subsetting. Searching for substrings. Lists.
4. Conditional operator. Logical operations. Loops.
5. Functions. Defining and calling functions. Recursive functions. Examples.

Recommended reading:

1) https://docs.python.org/3/tutorial/
2) https://developers.google.com/edu/python/
3) https://www.codecademy.com/learn/learn-python/

Linux platform

1. Running executable files from the terminal. Input/output. Input/output redirection.
2. Navigating file system. List files in directory, changing directories, creating directories.
3. Working with file from the terminal. Copying, moving, deleting files. Displaying contents with cat, less, head, tail.
4. File search. Examples of using find and grep tools.
5. Remote access with ssh. Running commands remotely. Copying files to and from remote server. Scp command.

Recommended reading:

1) https://www.digitalocean.com/community/tutorials/an-introduction-to-linux-basics
2) https://www.digitalocean.com/community/tutorials/an-introduction-to-the-linux-terminal
3) https://www.codecademy.com/learn/learn-the-command-line

4) Sander van Vugt, Beginning the Linux Command Line

Biology

1. General features of the prokaryotic and eukaryotic cells structure and functioning.
2. Catabolism and biosynthesis. Their coordination.
3. The structure and function of DNA. Chromosomal DNA and its packaging. The global structure of chromosomes.
4. DNA replication in prokaryotes and eukaryotes. DNA-polymerases.
5. Transcription in prokaryotes and eukaryotes. Types of eukaryotic RNA-polymerases. Transcription factors.
6. Translation in prokaryotes and eukaryotes. Ribosome. Translation factors.
7. m-RNA maturation. Splicing.
8. Cytoskeleton. Its components.
9. Cell membrane. Composition of the membrane. Membrane proteins.
10. Principles of membrane transport. Carrier proteins and active membrane transport. Ion channels.
11. Genetic engineering tools. Restriction enzymes .
12. General principles of cell signaling. The main signaling pathways and molecules.
13. The cellular basis of immunity. The functional properties of antibodies. The fine structure of antibodies.
14. Components of the cell-cycle control system. Intracellular control of cell-cycle events. Programmed cell death (apoptosis).
15. The Mechanics of Cell Division. Mitosis. Cytokinesis.

Recommended reading:

1) Alberts B., Johnson A., Lewis J., Raff M., Roberts K., Walter P. Molecular Biology of the Cell. Garland Sciences; edition V or higher. (или: Alberts B., Bray D., Hopkins K., Johnson A., Lewis J., Raff M., Roberts K., Walter P. Essential Cell Biology. Garland Sciences; edition III or higher).
2) Krebs J.E., Goldstein E.S., Kilpatrick S.T. Lewin's Genes. Jones & Bartlett Learning; edition X or higher.
3) Nelson D.L., Cox M.M. Lehninger's Principles of Biochemistry. W.H. Freeman Publishing, edition V or higher.
4) Thomas D. Pollard Cell biology.