International Information Technology University JSC

Faculty of Information Technology

Department of Computer Engineering and Information Security

Approved

Vice-Rector of Academic and Educational Affairs of IITU JSC, PhD

\_\_\_\_\_\_\_\_\_\_ Umarov T.F.

«\_\_\_» \_\_\_\_\_\_\_\_\_\_ 20\_\_

**SYLLABUS  
(ACADEMIC PROGRAM)**

**Course (code, title):** An Introduction to solving ACM ICPC problems (ACM-1)

(code, title):

**Major (code, title)**: 5B070300 - Information System

(code, title):

**Educational program** 6B06105 «Information System», 6B06103 «Big Data Analytics», 6B06104 «Business analysis»

(code, title)

**Year**: 3; **Semester:** 5 **Number of credits**: 5 ECTS

**Lectures:** 15 hours

**Laboratory classes:** 30 hours

**T/SIS:** 105 hours

**Total:** 150 hours

**Final assessment form**: Examination

Almaty 2020

Academic program of the course (code, title) An Introduction to solving ACM ICPC problems (ACM-1) has been developed on the basis of Standard Academic Program.

Academic program has been reviewed at the meeting of Information Systems department.

Minutes №. \_\_\_\_dated «\_\_\_\_\_» \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 20\_\_\_

Head of the Department\_\_\_\_\_\_\_\_\_\_\_ A.B. Kasymova

signature full name, title, degree

Author \_\_\_\_\_\_\_\_\_\_\_ Yeskendir Sultanov, senior lecturer, master

signature full name, title, degree

The working academic program was approved at the meeting of the Educational and Methodological Board of JSC "IITU"

Minutes № \_\_\_\_\_ dated "\_\_\_"\_\_\_\_\_\_\_\_\_\_\_ 20\_\_\_ .

Director of the Department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ A. Mustafina

*Signature*

for Academic Affairs

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| --- | --- |
| **1. GENERAL INFORMATION** | |
| Faculty | Information Technology |
| Major code and title | An Introduction to solving ACM ICPC problems (ACM-1) |
| Educational program code and title | 6B06105 «Information System», 6B06103 «Big Data Analytics», 6B06104 «Business analysis» |
| Year, semester | 3 year,  5 semester |
| Subject category | Elective |
| Number of credits (ECTS) | 5 |
| Prerequisites |  |
| Postrequisites |  |
| Lecturer | Yeskendir Sultanov, senior lecturer, master of science, office Innovation Center, 4 floor, [yeskendir.sultanov@gmail.com](mailto:yeskendir.sultanov@gmail.com),  11.00-13.00  Monday |
| **2. GOALS, OBJECTIVES AND LEARNING OUTCOMES OF THE COURSE** | |
| **The course goal is** learning of basic algorithms, basic data structures and creating the program to solve practical problems of competitive programming contests. | |
| **The objectives of the course are** introduction to the elementary algorithms to solving problems of competitive programming contests;  To use different algorithms for solving typical practical tasks;  To study how to solve easy problems by dividing them into subtasks;  To study basic data structures such as stack, queue, linked lists;  Mastering skills of programming using algorithms and data structures to solve easy practical problems. | |
| **Learning outcomes of the course**  **Students successfully completing the course will be able to:**  1.     To make the analysis depending on the limitation of the input data and use the appropriate algorithms  2.     To use appropriate data structures depending on their properties.  3.     To be able to solve problems by breaking them into subtasks  4.     To solve practical tasks quickly and efficiently.  5.     To compare and contrast the different ways of solving a problem after testing the program.  6.  To modify and rewrite the created program using the analysis. | |
| **3. Course description**  The course "An Introduction to solving ACM ICPC problems (ACM-1)" is designed for studying basic algorithms and data structures to solve different problems of competitive programming contests. For this purpose, using data structures, principles of construction of algorithms and programs, methods of solving, programming, debugging and implementation of programs are considered. | |
| **4. COURSE POLICY**  **Students are forbidden to:**   * submit any tasks after the deadline. Late submissions are graded down. * cheat. Plagiarized papers shall not be graded; * be late for classes. Being tardy three times amounts to one absence; * retake any tests, unless there is a valid reason for missing them; * use mobile phones in class; * chew gum in class.   **Students should always**   * be appropriately dressed (formal/semi- formal styles are acceptable); * show consideration for and mutual support of teachers and other students; * let the teacher know of any problems arising in connection with their studies. | |
| **5. LITERATURE** | |
| **Basic literature:**  1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to algorithms”, Third Edition, 2009.  2.   Kurt Mehlhorn, Peter Sanders. Algorithms and Data Structures: The Basic Toolbox, 2008.  3.   Donald E. Knuth, The Art of Computer Programming Volume 1-3.  **Supplementary literature:**  4. <http://e-maxx.ru>  5. <https://codeforces.com>  6. <https://csacademy.com>  7. <https://www.hackerrank.com>  8. [https://interviews.school](https://interviews.school/format)  9. [https://leetcode.com](https://leetcode.com/) | |
|  | |

1. **Course schedule**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Week/**  **date** | **Course topics** | **References** | **Lectures**  **(h/w)** | **Practical sessions**  **(h/w)** | **Lab. sessions (h/w)** | **TSIS**  **(h/w)** | **SIS**  **(h/w)** |
| 1 | An Introduction to Competitive Programming. Advantages of being a competitive programmer. Interview processes. Practice on arrays and strings. | [7]  [8]  [9] | 1 |  | 2 | 2 | 4 |
| 2 | Time complexity. Sorting. | [1]  [7]  [8]  [9] | 1 |  | 2 | 2 | 4 |
| 3 | Sets and Maps. | [7]  [5] | 1 |  | 2 | 2 | 4 |
| 4 | Stack. Queue. | [1]  [2]  [3] | 1 |  | 2 | 2 | 4 |
| 5 | Linked list. | [1]  [2]  [3]  [8]  [9] | 1 |  | 2 | 2 | 4 |
| 6 | Priority Queue. | [1]  [2] | 1 |  | 2 | 2 | 4 |
| 7 | Math. Number theory. | [1]  [2]  [4]  [5]  [6] | 1 |  | 2 | 2 | 4 |
| 8 | Recursion. | [1]  [2] | 1 |  | 2 | 2 | 4 |
| 9 | Backtracking. | [1]  [2]  [8]  [9] | 1 |  | 2 | 2 | 4 |
| 10 | Two pointers. | [5]  [7]  [8]  [9] | 1 |  | 2 | 2 | 4 |
| 11 | Binary Search. | [1]  [2]  [5]  [7]  [8]  [9] | 1 |  | 2 | 2 | 4 |
| 12 | Bit operation. | [1]  [2]  [5]  [6]  [7]  [8]  [9] | 1 |  | 2 | 2 | 4 |
| 13 | Dynamic programming. | [1] | 1 |  | 2 | 2 | 4 |
| 14 | Two dimension dynamic programming. | [1] | 1 |  | 2 | 2 | 4 |
| 15 | DP Longest increasing subsequence. DP Longest common subsequence. | [1] | 1 |  | 2 | 2 | 4 |
|  | **Total hours:** |  | **15** |  | **30** | **30** | **60** |

1. **List of topics/ assignments for laboratory classes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **№** | **Topic Title** | **Number of hours** | **References** | **Form of reporting** | **Deadline** |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | Laboratory work #1. Arrays and strings. | 3 |  | Report | Week 2 |
| 2 | Laboratory work #2. Sorting. | 3 |  | Report | Week 3 |
| 3 | Laboratory work #3. Sets and Maps. | 3 |  | Report | Week 4 |
| 4 | Laboratory work #4. Stack. Queue. | 3 |  | Report | Week 5 |
| 5 | Laboratory work #5. Linked List. | 3 |  | Report | Week 6 |
| 6 | Laboratory work #6. Priority Queue. | 3 |  | Report | Week 8 |
| 7 | Laboratory work #7. Recursion. Backtracking. | 3 |  | Report | Week 10 |
| 8 | Laboratory work #8. Two pointers. Binary Search. | 3 |  | Report | Week 12 |
| 9 | Laboratory work #9. Bit Operation. | 3 |  | Report | Week 13 |
| 10 | Laboratory work #10. Dynamic programming. | 3 |  | Report | Week 15 |

1. **List of topics/** **assignments for practical classes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **№** | **Topic Title** | **Number of hours** | **References** | **Form of reporting** | **Deadline** |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |

1. **List of topics/assignments for Student Independent Study**

Proper organization of students independent study is the key to the formation of skills in mastering, learning, assimilation and systematization of acquired knowledge, ensuring a high level of academic performance in the learning process

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **№** | **Topic/Assignment title** | **Number of hours** | **References** | **Form of reporting** | **Deadline** |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | SIS I. Working with Git. Resume building. | 30 |  | Report | Week 7 |
| 2 | SIS II. Making 5 Mockup Interviews. | 30 |  | Report | Week 14 |

1. **System for evaluating student performance in a discipline:**

*Option 1*

|  |  |  |  |
| --- | --- | --- | --- |
| **Period** | **Assignments** | **Score** | **Total** |
| 1st attestation | **Laboratory works:**  Lab work 1,  Lab work 2,  Lab work 3,  Lab work 4,  Lab work 5,  **Mid-term**  **SIS assignments** | **50**  10  10  10  10  10  **35**  **15** | **100** |
| 2nd attestation | **Laboratory works:**  Lab work 6,  Lab work 7,  Lab work 8,  Lab work 9,  Lab work 10,  **End-of-term**  **SIS assignments** | **50**  10  10  10  10  10  **35**  **15** | **100** |
| **Exam** | | | **100** |
| **Total** | **0,3\*1stAtt+0,3\*2ndAtt+0,4\*Final** | |  |

\*If the number of absences exceeds 20%, student will be automatically scheduled for a Retake (summer semester)

**11. Assessment criteria:**

The point-rating letter system for assessing the educational achievements of students with their interpretation in the traditional grading scale:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Letter Grade | Numerical equivalent | Points (%) | Traditional system assessment | General description of grading criteria |
| А | 4,0 | 95-100 | Excellent | The student has knowledge of the subject in the full scope of the curriculum, understands the discipline deeply enough; shows a high level of knowledge that exceeds the volume provided by the syllabus, gives an exhaustive answer |
| А- | 3,67 | 90-94 | The student has knowledge of the subject in the full scope of the curriculum, understands the discipline deeply enough; gives an exhaustive answer |
| В+ | 3,33 | 85-89 | Good | The student shows a complete, well-founded knowledge of the subject, but the answers did not always highlight the main idea, rational methods of calculation were not always used; the answers were mostly brief and sometimes unclear. |
| В | 3,0 | 80-84 |
| В- | 2,67 | 75-79 |
| С+ | 2,33 | 70-74 |
| C | 2,0 | 65-69 | Satisfactory | The student demonstrates sufficient knowledge of the subject, but without proper depth and justification, the answers are unclear and without proper logical sequence. |
| С- | 1,67 | 60-64 |
| D+ | 1,33 | 55-59 |
| D | 1,0 | 50-54 |
| FX | 0,5 | 25-49 | Unsatisfactory | The student demonstrates insufficient knowledge of the subject, positive answers were not given to individual questions. |
| F | 0 | 0-24 | The student demonstrates a very low level of knowledge of the subject. |