British Informatics Olympiad

CONFIDENTIAL before 3 April 2006

LIONHEAD STUDIOS

The 2006 British Informatics Olympiad Marking Scheme

Instructions for setting the 2006 British Informatics Olympiad

Students should each have a computer with their chosen programming language installed.

They should also each have a calculator, pen and paper, and a blank floppy disk (or other storage device) on which to back up their work and save their solution programs.

If possible, please disable any network to prevent students from communicating.

Please allow the students a few minutes to carefully read the rubric; during this time they must not turn over the page and look at the questions. Please also encourage the students to read the questions first before attempting any answers.

The 3 hour time limit should start once you allow them to turn the page and begin the exam.

Marking instructions

For each competitor you should have a set of programs and a written paper. The programs for parts 1(a), 2(a) and 3(a) are to be tested by running them with data specified in this marks scheme – you do not need to look at their program code. The written answers can also be marked as specified here, without needing any specialist knowledge.

The program names used by competitors should be clearly marked on their papers. Failure to do this, or to compile programs where necessary, should not prevent programs being marked, but deduct [2] marks for every such program. Programs produced by the competitors to help in the written questions may be used in selecting the BIO 2006 finalists.

If a student gets a negative number of marks on any question, score that question as a 0.

Programs written for 1(a), 2(a) and 3(a) are to be 'black-box' tested: you should run the program, enter the given data and verify the solution. For each of these tests the data to be entered is given in **`bold text`**. The output format is flexible (there is no penalty for extra spaces etc.), but the solutions must be correct for marks to be scored. Input and output may appear in different windows.

Note that, if a program does not complete a test in 10 seconds of processing time, it should be interrupted and the rest of that test ignored. The other questions should be marked from the competitors' written answers.

All marks are given in square brackets by the test/answer they relate to. Answers not covered under the mark scheme should get no marks. In some cases details are given on how marks may be given for partial answers, as well as alternative answers which merit marks.

Accompanying this marks scheme are two forms. The script cover sheet is designed to assist you with marking each student's answers. Use the marks submission sheet to list the marks for all your students, including those who submitted no solutions or left early. This information helps us to assess the level of the exam and allows us to send out certificates for every student who takes part.

Please send us the mark submission sheet and all cover sheets. For any student who scores 50 or more marks, please send us their written answers by mail, and email their programs. If none of your students score 50 or higher, please send us the material from your highest scoring student.

To help us send you certificates promptly, please **submit all your marks to us electronically**, in addition to mailing the marks submission sheet, using the form at *http://www.olympiad.org.uk/2006/bio-marks-2006.html*. The closing deadline for the return of marks, for students to be considered for the final, is 13 March.

Finally, thank you very much for participating in BIO 2006!

Question 1(a) [24 marks available]

For each test of the program for 1(a) you need to type in two words (in capitals). Students' programs will *probably* expect the words to be on separate lines - you may enter words separated by a space or comma if required by a student's program. The correct response is given to the right of each pair. There are no marks for incorrect answers.

[1]	**OLYMPIAD** **OLYMPIAD**	Anagrams
[2]	**LEMON** **MELON**	Anagrams
[2]	**COVERSLIP** **SLIPCOVER**	Anagrams
[2]	**TEARDROP** **PREDATOR**	Anagrams
[2]	**ABBCCCDDD** **DDDCCCBBA**	Anagrams
[1]	**I** **A**	Not anagrams
[2]	**FORTY** **FORT**	Not anagrams
[2]	**ONE** **SIX**	Not anagrams
[2]	**GREEN** **RANGE**	Not anagrams
[2]	**ABBCCCDDD** **AAABBBCCD**	Not anagrams

Additional marks are available for general program behaviour:

[2] Program inputs two words
[2] For each test, either `Anagrams` or `Not anagrams` is output
[2] Program terminates with crashing / hanging

Question 1(b) [2 marks available]

[2] 6

Question 1(c) [4 marks available]

[4] 21

(**Supplementary:** 6 is worth [2] marks.)

Question 2(a) [24 marks available]

For each test of the program for 2(a) you need to type in three lines of input. The first line will be a combination of the symbols **x**, **u**, **d**, *****, **?**, **(** and **)**. The next two lines will be integers, which may have leading **0**s.

Output should consist of two lines, each of which will be either `Yes` or `No`. *Both* lines of output must be correct for marks to be scored. Each test is worth [2] marks.

Test 1

	x **7** **12**
[2]	Yes No

Test 2

	xux **667** **65**
[2]	No No

Test 3

	xddu **8654** **2102**
[2]	No Yes

Test 4

	xuxd **9801** **4543**
[2]	No Yes

Test 5

	xx* **0** **2006**
[2]	Yes Yes

Test 6

	xd*u? **56** **54322**
[2]	Yes No

Test 7

	x?x **1** **11**
[2]	Yes Yes

Test 8

	x?x **123** **4567**
[2]	No No

Test 9

	x*xu **7654** **2**
[2]	No No

Test 10

	x(xud)? **789** **7890**
[2]	No Yes

Test 11

	x(xd)?(xu)? **421** **422**
[2]	Yes No

Test 12

	x(ud)*u? **0836** **19181716151**
[2]	Yes Yes

Question 2(b) [3 marks available]

[3] 46010

(**Supplementary:** 46460 is worth [1] mark.)

Question 2(c) [3 marks available]

[3] `x(ud)*u?`

Question 2(d) [5 marks available]

[1] No

[1] 9 successive `u`s (or `d`s) after an `x` are required to match a unique password.

Up to [1] mark is available for some justification for the above point. Suitable justifications are:

- The only symbols that restrict the choices of digit are `u` and `d`.
- An example of how a shorter successive sequence leads to multiple passwords.
- An example of how a mixed sequence leads to multiple passwords.

[1] Adding a `u` (in the case of successive `u`s) leads to zero valid passwords.

Up to [1] from either:

[1] Adding a `*` or `?` to one of the above sequences leads to an increased number of valid passwords.
[1] Adding an `x` or `u` (in the case successive `d`s) leads to an increased number of valid passwords. (Alternatively for `d` in the case of successive `u`s).

Question 3(a) [25 marks available]

Each test for 3(a) consists of two integers for input and a single integer for output. There are no marks for incorrect answers.

[1]	**7 3**	6
[2]	**33 1**	0
[2]	**101 4**	0
[2]	**8 7**	1
[2]	**28 1**	1
[2]	**18 2**	8
[2]	**9 4**	22
[2]	**36 3**	191
[2]	**33 4**	2075
[2]	**83 5**	40000
[3]	**73 6**	1402584
[3]	**95 8**	515725220

Question 3(b) [2 marks available]

[1] 61 (after 2 drats)
[1] 81 (after 3 drats)

Question 3(c) [4 marks available]

[4] 510176

Question 3(d) [4 marks available]

[1] No

[1] High & even segments could only be next to low & odd segments and vice-versa. (Similarly for high & odd / low & even).

[1] A board which alternates high & even with low & odd segments cannot have high & odd or low & even segments.

[1] The segments 1 to 20 include high & even, high & odd, low & even and low & odd segments.

End of BIO 2006 marks scheme

British Informatics Olympiad

2006 British Informatics Olympiad
Script Cover Sheet

LIONHEAD STUDIOS

Please use this sheet, with reference to the marks scheme, to assist you with marking each student's script. This cover sheet should accompany all scripts submitted to the BIO organisers. As it summarises the solutions to many questions, **do not distribute or show this sheet to any contestant before 3 April 2006.**

Name of Student: Age: School Year:

1(a)

input	OLYMPIAD	LEMON	COVERSLIP	TEARDROP	ABBCCCDDD	I	FORTY	ONE	GREEN	ABBCCCDDD
	OLYMPIAD	MELON	SLIPCOVER	PREDATOR	DDDCCCBBA	A	FORT	SIX	RANGE	AAABBBCCD
	(1)	(2)	(2)	(2)	(2)	(1)	(2)	(2)	(2)	(2)
output	← Anagrams →					← Not anagrams →				

Inputs words? (2)
Outputs words? (2)
Exists okay? (2)

1(b) *Ans: 6* (2)

1(c) *Ans: 21* (4)

(Supl. 6 scores [2])

TOTAL 1(a) (24)

2(a)

	x	xux	xddu	xuxd	xx*	xd*u?	x?x	x?x	x*xu	x(xud)?	x(xd)?(xu)?	x(ud)*u?
	7	667	8654	9801	0	56	1	123	7654	789	421	0836
input	12	65	2102	4543	2006	54322	11	4567	2	7890	422	19181716151
	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
output	Yes	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes
	No	No	Yes	Yes	Yes	No	Yes	No	No	Yes	No	Yes

2(b) *Ans: 46010* (3)

2(c) x(ud)*u? (3)

2(d) *(see marks scheme)* (5)

(Supl. 46460 scores [1])

TOTAL 2(a) (24)

3(a)

input	7 3	33 1	101 4	8 7	28 1	18 2	9 4	36 3	33 4	83 5	73 6	95 8
	(1)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(3)	(3)
output	6	0	0	1	1	8	22	191	2075	40000	1402584	515725220

3(b) *Ans: 61 and 81* (1)+(1)

3(c) *510176* (4)

3(d) *(see marks scheme)* (4)

TOTAL 3(a) (25)

Deduct **[2]** *marks for every part (a) program name that is not clearly marked on the script, or where the student has failed to compile the program for languages that require compiling.*

Please use the back of this sheet for any further comments.

TOTAL Q1	TOTAL Q2	TOTAL Q3
(30)	(35)	(35)

TOTAL BIO 2006 (100)

Marked by:

Send to: Dr Richard Forster, British Informatics Olympiad, Flat B, 20 East Heath Road, Hampstead, London, NW3 1AJ

British Informatics Olympiad

2006 British Informatics Olympiad
Marks Submission Sheet

Please use BLOCK CAPITALS

Please fill in details of the school/college and each pupil's name as they should appear on certificates. There is room for 10 entrants in the marks submission table, so duplicate this page if more space is required. It would also be very helpful for us to know what hardware, operating system and programming language(s) each entrant used; please list the different combinations you used in the computer summary table.

Please **submit all your marks to us electronically**, using the form at *http://www.olympiad.org.uk/2006/bio-marks-2006.html*. In addition, please send us copies of the completed marks submission forms and all cover sheets by post, along with the scripts from your **highest-scoring student**, and all others who score **over 50 marks**. Please email the source-code for any students whose scripts you return.

School / College: _____ Date exam taken: _____

Name of marker: _____ Date exam marked: _____

Name of Entrant (as it should appear on certificate)	Marks for each section (maximum in brackets)											Total (100) †	PC/ Lang ‡	School Year §	Age	M/F
	1a (24)	1b (2)	1c (4)	2a (24)	2b (3)	2c (3)	2d (5)	3a (25)	3b (2)	3c (4)	3d (4)					

† Write **N/S** (no submission) in this column if the student produced no answers.

‡ Give the number of the machine and language type in the computer / language type table below

§ Please indicate the type of enumeration used, e.g. year band / curriculum level: _____

Type Number	Hardware *e.g. PC / Mac*	Processor *e.g. Pentium 4 (2 Ghz)*	Operating System *e.g. Mac OS X*	Programming Language *e.g. Visual C++*
1				
2				
3				
4				

Send to: Dr Richard Forster, British Informatics Olympiad, Flat B, 20 East Heath Road, Hampstead, London, NW3 1AJ