

CM20214/CM20221A
ADVANCED PROGRAMMING PRINCIPLES
COURSEWORK

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This assignment is worth 20% of the total marks for the course. It is due by 5pm, 19 April 2012. Exceptions may only be granted by the Director of Studies.

Specification

Use Prolog to solve the following problem.

Let X and Y be two integers with $1 < X < Y$ and $X + Y \leq 100$. The mathematician S is given their sum $X + Y$ and the mathematician P is given their product XY . The following conversation takes place:

- (a) P: I do not know the two numbers.*
- (b) S: I knew you didn't know. I don't know either.*
- (c) P: Now I know the two numbers.*
- (d) S: Now I know the two numbers.*

What are the numbers?

The solution to the problem will be a Prolog program that accomplishes the following tasks:

- (1) The goal `s1(Q, 100)` will bind Q with a list of quadruples $[X, Y, S, P]$, where $S = X + Y$ and $P = XY$ and X and Y are possible solutions after sentence (a) is pronounced. The list will be ordered by ascending values of S .
- (2) The goal `s2(Q, 100)` will bind Q with a list of quadruples $[X, Y, S, P]$, where $S = X + Y$ and $P = XY$ and X and Y are possible solutions after sentence (b) is pronounced. The list will be ordered by ascending values of P .
- (3) The goal `s3(Q, 100)` will bind Q with a list of quadruples $[X, Y, S, P]$, where $S = X + Y$ and $P = XY$ and X and Y are possible solutions after sentence (c) is pronounced. The list will be ordered by ascending values of S .
- (4) The goal `s4(Q, 100)` will bind Q with a value $[[X, Y, S, P]]$, where $S = X + Y$ and $P = XY$ and X and Y are the solution of the problem.
- (5) The goal `s4(Q, 500)` will bind Q with a list of quadruples $[X, Y, S, P]$, where $S = X + Y$ and $P = XY$ and X and Y are the solution of the problem above, when the constraint on the sum is changed into $X + Y \leq 500$. The query is to be answered in less than three hours by an ordinary computer.

Assessment Criteria

- The total of marks is 100, and each task contributes for at most 20 marks.
- The maximum grade for each task can only be obtained if the relative part of the program does not contain any Prolog built-in functions and predicates, with the exception of arithmetic functions, comparison and assignment predicates

and the cut '!'. If built-ins are used, such as `findall`, `forall`, `bagof`, etc., the maximum grade for each task that employs them is 10.

- The program should not admit multiple answers, under penalty of 5 marks.
- Every predicate definition should be very briefly commented, in such a way that who marks can understand the idea without trying to interpret the code.
- At the top of the program file there should be a comment like this:

```
/*
1. < Number of elements in the list binding Q after executing s1(Q,100) >
   < At most 300 characters of clear text on the main idea for the definition of s1. >
2. < Number of elements in the list binding Q after executing s2(Q,100) >
   < At most 300 characters of clear text on the main idea for the definition of s2. >
3. < Number of elements in the list binding Q after executing s3(Q,100) >
   < At most 300 characters of clear text on the main idea for the definition of s3. >
4.
   < At most 300 characters of clear text on the main idea for the definition of s4. >
5. < Number of elements in the list binding Q after executing s4(Q,500) >
*/
```

Please adhere strictly to the structure above.

- At the bottom of the program file there should be a comment containing a complete capture from the terminal of the execution of the five goals required, including their running time, *i.e.* something like:

```
/*
?- consult(<username>).
%<username> compiled 0.00 sec, <...> bytes
true.

?- time(s1(Q,100)).
%<...> inferences, <...> CPU in <...> seconds (100% CPU,
<...> Lips)
Q = [[3,4,7,12],[2,6,8,12], <rest of complete list of quadruples>]

?- time(s2(Q,100)).
Q = <...>

<...>
*/
```

- Comments are worth 20 marks at most.

Handing In

By email to the instructor. Send an empty email with an attachment and whose subject is `<username>`, where `<username>` is your BUCS ID. The attachment will be one uncompressed ASCII file named `<username>.pl`. The file should be consultable by Prolog as is. Send the email to `ag248@bath.ac.uk`.

Feedback

In a problem class after the hand-in.

Please read very carefully the above instructions and adhere to them strictly.

One more time:

Please read very carefully the above instructions and adhere to them strictly.