

Логическое программирование

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1 Задание

1.1 Условие

`sum/2` с использованием `plus/3` и без

1.2 Решение 1

`plus(A, B, C)` истина, если $C = A + B$

`A natural_number`

`B natural_number`

`C natural_number`

`natural_number(0).`

`natural_number(s(X)) :- natural_number(X).`

`plus(A, 0, A) :-`

`natural_number(A).`

`plus(A, s(B), s(Res)) :-`

`natural_number(A),`

`natural_number(B),`

`plus(A, B, Res).`

`sum(Xs, X)` истина, если X равен сумме элементов списка Xs

Xs список, каждый элемент которого имеет тип `natural_number`

X `natural_number`

1.2.1 Исходный код

```
sum([], 0).
sum([X | Xs], Y) :-
    list(Xs),
    sum(Xs, Z),
    plus(X, Z, Y).
```

1.2.2 Тесты

- `sum(+, +)`

```
sum([s(0)], s(0)).
true
?- sum([s(0), s(s(0))], s(s(s(0)))).
true
?- sum([s(0), s(s(0))], s(s(0))).
false
```

- `sum(+, -)`

```
% sum([ 1 ]) = 1
sum([s(0)], X).
```

```
X = s(0)
```

```
% sum([ 2 ]) = 2
sum([s(s(0))], X).
```

```
X = s(s(0))
```

```
% sum([2, 1]) = 3
sum([s(s(0)), s(0)], X).
```

```
X = s(s(s(0)))
```

```
%sum([2, 2]) = 4
sum([s(s(0)), s(s(0))], X).
```

```
X = s(s(s(s(0))))
```

```
%sum([2, 2, 1]) = 5
sum([s(s(0)), s(s(0)), s(0)], X).
```

```
X = s(s(s(s(s(0)))))
```

1.3 Решение 2

1.3.1 Исходный код

sum_(Xs, X) истина, если X равен сумме элементов списка Xs

Xs список, каждый элемент которого имеет тип `natural_number`

X `natural_number`

```
sum_([], 0).
sum_([0 | Xs], Y) :-
    list(Xs),
    sum_(Xs, Y).
sum_([s(X) | Xs], s(Y)) :-
    list(Xs),
    sum_([X | Xs], Y).
```

1.3.2 Тесты

- `sum_(+, +)`

```
sum([s(0)], s(0)).
```

true

```
?- sum([s(0)], s(0)).
```

true

```
?- sum([s(0), s(s(0))], s(s(s(0)))).
```

true

```
?- sum([s(0), s(s(0))], s(s(0))).
```

false.

- `sum(+, -)`

```
%sum([2, 2, 1]) = 5
sum([s(s(0)), s(s(0)), s(0)], X).
```

```
X = s(s(s(s(s(0)))))
```

```
%sum([]) = 0
sum([], X).
```

```
X = 0
```

- $\text{sum_}(-, +)$

$$\text{sum_}(X, \text{ s }(\text{ s }(\text{ s }(0)))) .$$

$$X = [0, \text{ s }(\text{ s }(\text{ s }(0)))]$$

$$X = [0, 0, \text{ s }(\text{ s }(\text{ s }(0)))]$$

$$X = [0, \text{ s }(0), \text{ s }(\text{ s }(0))]$$

$$X = [0, \text{ s }(\text{ s }(0)), \text{ s }(0)]$$

$$X = [0, \text{ s }(\text{ s }(\text{ s }(0))), 0]$$

$$X = [0, 0, 0, \text{ s }(\text{ s }(\text{ s }(\text{ s }(0))))]$$

$$X = [0, 0, \text{ s }(0), \text{ s }(\text{ s }(0))]$$

$$X = [0, 0, \text{ s }(\text{ s }(0)), \text{ s }(0)]$$

$$X = [0, 0, \text{ s }(\text{ s }(\text{ s }(0))), 0]$$

$$X = [0, \text{ s }(0), 0, \text{ s }(\text{ s }(0))]$$

$$X = [0, \text{ s }(0), \text{ s }(0), \text{ s }(0)]$$

$$X = [0, \text{ s }(0), \text{ s }(\text{ s }(0)), 0]$$