

# CS 354N LAB 2

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## Question 1

Code:

```
≡ q1.pl  ×
≡ q1.pl
1  reverse([], []).
2  reverse([H|T], Rev) :- reverse(T, RT), append(RT, [H], Rev).
3
4  % reverse([1, 2, 3, 4], Rev).
5
```

Result:

```
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?- reverse([1, 2, 3, 4], Rev).
Rev = [4, 3, 2, 1].

?-
```

## Question 2

Code:

```
≡ q2.pl  ×
≡ q2.pl
1  element_at(H,[H|_],1):- !.
2  element_at(A,[_|T],N) :- N1 is N - 1, element_at(A,T,N1).
3
4  % query:
5  % element_at(X,[a,b,c,d,e],3).
6
```

Result:

```
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?- element_at(X,[a,b,c,d,e],3).
X = c.

?-
```

## Question 3

Code:

```
q3.pl
1 reverse([],A,A).
2 reverse([H|T],A,Acc) :- reverse(T,A,[H|Acc]).
3 palindrome(L):- reverse(L, L, []).
4
5 % query:
6 % palindrome([1, 2, 3, 2, 1]).
7 % palindrome([1, 2, 3, 2]).
```

Result:

```
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?- palindrome([1, 2, 3, 2, 1]).
true.

?- palindrome([1, 2, 3, 2]).
false.

?- 
```

## Question 4

Code:

```
q4.pl
6  next_factor(_,2,3) :- !.
7  next_factor(N,F,NF) :- F * F < N, !, NF is F + 2.
8  next_factor(N,_,N).
9
10 prime_factors_mult(N,L) :- N > 0, prime_factors_mult(N,L,2).
11
12 prime_factors_mult(1,[],_) :- !.
13 prime_factors_mult(N,[[F,M]|L],F) :- division(N,F,M,R), !, next_factor(R,F,NF), prime_factors_mult(R,L,NF).
14 prime_factors_mult(N,L,F) :- !, next_factor(N,F,NF), prime_factors_mult(N,L,NF).
15
16 % query :
17 % prime_factors_mult(315, L).
18 % prime_factors_mult(1000, L).
```

Result:

```
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o arnav@arnav-IdeaPad-Gaming-3-15ACH6:~/Desktop/CI LAB/LAB 2$ prolog q4.pl
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?- prime_factors_mult(315, L).
L = [[3, 2], [5, 1], [7, 1]].

?- prime_factors_mult(1000, L).
L = [[2, 3], [5, 3]].

?- 
```

## Question 5

Code:

```
q5.pl
1 gcd(N,0,N) :- N > 0, !.
2 gcd(N,M,GCD) :- M > 0, R is N mod M, gcd(M,R,GCD).
3
4 coprime(N,M) :- gcd(N,M,1).
5
6 % query:
7 % coprime(35, 64).
8 % coprime(35, 65).
```

Result:

```
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?- coprime(35, 64).
true.

?- coprime(35, 65).
false.

?-
```

## Question 6

Code:

```
q6.pl
1 my_flatten([],[]):- !.
2 my_flatten(A,[A]) :- \+ is_list(A).
3 my_flatten([A|A1],C1) :- my_flatten(A,B), my_flatten(A1,B1), append(B,B1,C1).
4
5 % query:|
6 % my_flatten([a, [b, [c, d], e]], X).
7 % my_flatten([a, [b, [c, d], e, [x, y, z, p]]], X).
```

Result:

```
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?- my_flatten([a, [b, [c, d], e]], X).
X = [a, b, c, d, e].

?- my_flatten([a, [b, [c, d], e, [x, y, z, p]]], X).
X = [a, b, c, d, e, x, y, z, p].

?-
```

## Question 7

Code:

```
q7.pl
1 compress([], []).
2 compress([H], [H]).
3 compress([H,H|T], X) :- compress([H|T], X).
4 compress([H|T], [H|X]) :- compress(T, X).
5
6 % query:
7 % compress([a,a,a,a,b,c,c,a,a,d,e,e,e,e], X).
8
9
```

Result:

```
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?- compress([a,a,a,a,b,c,c,a,a,d,e,e,e,e], X).
X = [a, b, c, a, d, e] []
```

## Question 8

Code:

```
q8.pl
1 combination(0, _, []).
2
3 combination(K, [H|T], [H|Comb]) :- K > 0, K1 is K - 1, combination(K1, T, Comb).
4
5 combination(K, [_|T], Comb) :- K > 0, combination(K, T, Comb).
6
7 % query:
8 % combination(3, [a,b,c,d,e,f], L).
9
```

Result:

```
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?- combination(3, [a,b,c,d,e,f], L).
L = [a, b, c] ;
L = [a, b, d] ;
L = [a, b, e] ;
L = [a, b, f] ;
L = [a, c, d] ;
L = [a, c, e] ;
L = [a, c, f] ;
L = [a, d, e] ;
L = [a, d, f] ;
L = [a, e, f] ;
L = [b, c, d] ;
L = [b, c, e] ;
L = [b, c, f] ;
L = [b, d, e] ;
L = [b, d, f] ;
L = [b, e, f] ;
L = [c, d, e] ;
L = [c, d, f] ;
L = [c, e, f] ;
L = [d, e, f] ;
false.

?-
```



## Question 9

Code:

```
q9.pl
1  add_key([], []).
2  add_key([A|A1], [L-p(A)|B1]) :-!, length(A,L), add_key(A1,B1).
3
4  rem_key([], []).
5  rem_key([_p(A)|A1], [A|B1]) :- rem_key(A1,B1).
6
7  lsort(In,Out) :- add_key(In,K), keysort(K,SK), rem_key(SK,Out).
8
9  % query:
10 % lsort([[a,b,c],[d,e],[f,g,h],[d,e],[i,j,k,l],[m,n],[o]],L).
```

Result:

```
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?- lsort([[a,b,c],[d,e],[f,g,h],[d,e],[i,j,k,l],[m,n],[o]],L).
L = [[o], [d, e], [d, e], [m, n], [a, b, c], [f, g, h], [i, j|...]].

?-
```

## Question 10

Code:

```
q10.pl
1  add_key([], []).
2  add_key([A|A1], [L-p(A)|B1]) :-!, length(A, L), add_key(A1, B1).
3
4  rem_key([], []).
5  rem_key([_p(A)|A1], [A|B1]) :- rem_key(A1, B1).
6
7  lsort(In, Out) :- add_key(In, K), keysort(K, SK), rem_key(SK, Out).
8
9  pack([], []).
10 pack([L-A|A1], [[L-A|C]|C1]) :- transf(L-A, A1, B1, C), pack(B1, C1).
11
12 transf(_, [], [], []).
13 transf(L-_, [K-B|B1], [K-B|B1], []) :- L \= K.
14 transf(L-_, [L-A|A1], B1, [L-A|C1]) :- transf(L-A, A1, B1, C1).
15
16 lfsort(In, Out) :- add_key(In, K), keysort(K, SK), pack(SK, PK), lsort(PK, SPK), flatten(SPK, FK), rem_key(FK, Out).
17
18 % query:
19 % lfsort([[a,b,c],[d,e],[f,g,h],[d,e],[i,j,k,l],[m,n],[o]],L).
20
```

Result:

```
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?- lfsort([[a,b,c],[d,e],[f,g,h],[d,e],[i,j,k,l],[m,n],[o]],L).
L = [[o], [i, j, k, l], [a, b, c], [f, g, h], [d, e], [d, e], [m, n]]
```

GitHub for the code files

<https://github.com/arnavjain2710/Computational-Intelligence-Lab-CS354N/tree/main/LAB%202>