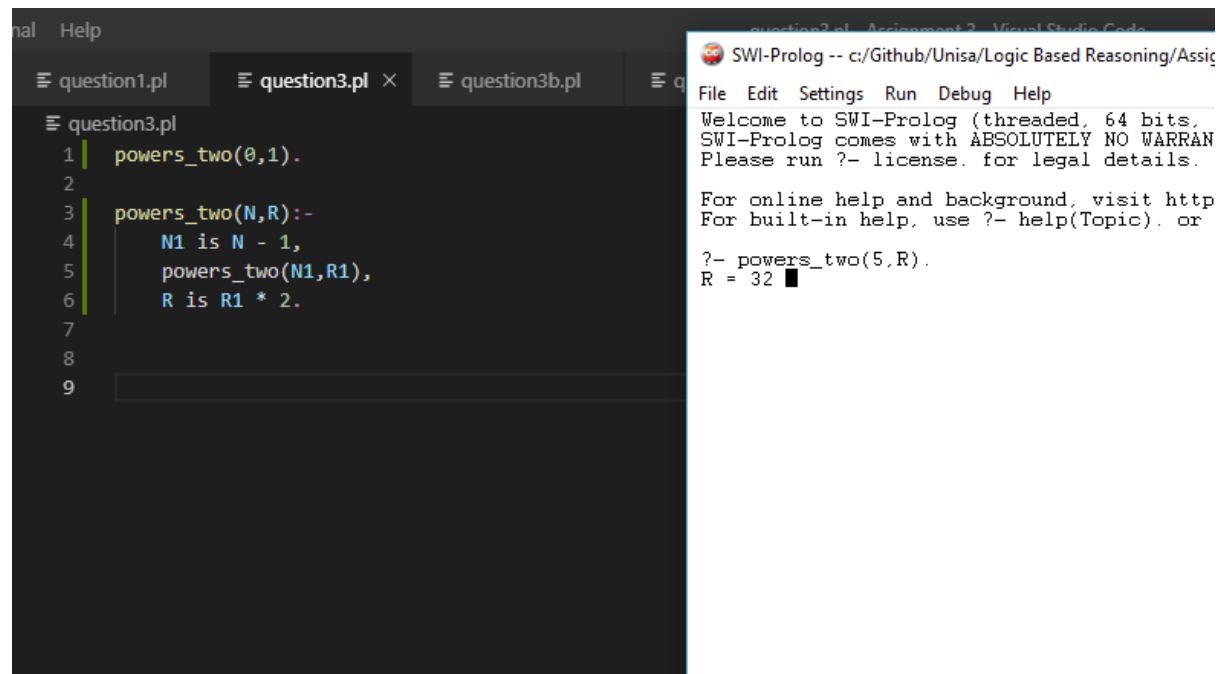


QUESTION 1

QUESTION 2



The image shows a Visual Studio Code editor window with a dark theme. The editor has several tabs open: 'question1.pl', 'question3.pl' (which is the active tab), 'question3b.pl', and another partially visible tab. The 'question3.pl' tab contains the following Prolog code:

```
1 powers_two(0,1).
2
3 powers_two(N,R):-
4     N1 is N - 1,
5     powers_two(N1,R1),
6     R is R1 * 2.
7
8
9
```

Below the code editor, there is a terminal window titled 'SWI-Prolog -- c:/Github/Unisa/Logic Based Reasoning/Assig...'. The terminal shows the output of the Prolog program:

```
File Edit Settings Run Debug Help
Welcome to SWI-Prolog (threaded, 64 bits,
SWI-Prolog comes with ABSOLUTELY NO WARRANTY
Please run ?- license. for legal details.

For online help and background, visit http
For built-in help, use ?- help(Topic). or

?- powers_two(5,R).
R = 32
```

QUESTION 3

```
File Edit Selection View Go Debug Terminal Help
question2.pl x
C:\Github> Unisa > Logic Based Reasoning > Assignment 3 > question2.pl
1 %remove one object from list. In case there are duplicates
2 deleteFirst(.,[],[]).
3 deleteFirst(0,[0,T],T).
4 deleteFirst(0,[H,T],[H|R]):-
5   deleteFirst(0,T,R).
6
7 getPermutation([H|T],R):-
8   getPermutation(T,R1),
9   deleteFirst(H,R,R1).
10
11 getPermutation([],[]).
12
13 knapsack(Objects_Available,Target_weight,Objects_included):-
14   getPermutation(Objects_Available,Objects_included),
15   isValidSolution(Objects_included,Target_weight).
16
17 isValidSolution(Objects,Size):-
18   sum_list(Objects,Sum),
19   Sum == Size.
20
21
22
23
24
25
26
```

```
SWI-Prolog -- c:\Github\Unisa\Logic Based Reasoning\Assignment 3\question2.pl
File Edit Settings Run Debug Help
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For online help and background, visit http://www.swi-prolog.org
For built-in help, use ?- help(Topic). or ?- apropos(Word).
?- knapsack2([2,7,18,5,10,3],20,L).
L = [2, 18] ;
L = [18, 2] ;
L = [2, 5, 10, 3] ;
L = [5, 2, 10, 3] ;
L = [5, 10, 2, 3] ;
L = [5, 10, 3, 2] ;
L = [2, 10, 5, 3] ;
L = [10, 2, 5, 3] ;
L = [10, 5, 2, 3] ;
L = [10, 5, 3, 2] ;
L = [7, 10, 3] ;
L = [10, 7, 3] ;
L = [10, 3, 7] ;
L = [2, 10, 3, 5] ;
L = [10, 2, 3, 5] ;
L = [10, 3, 2, 5] ;
L = [10, 3, 5, 2] ;
L = [2, 5, 3, 10] ;
L = [5, 2, 3, 10] ;
L = [5, 3, 2, 10] ;
L = [5, 3, 10, 2] ;
L = [2, 3, 5, 10] ;
L = [3, 2, 5, 10] ;
L = [3, 5, 2, 10] ;
L = [3, 5, 10, 2] ;
L = [7, 3, 10] ;
L = [3, 7, 10] ;
L = [3, 10, 7] ;
L = [2, 3, 10, 5] ;
L = [3, 2, 10, 5] ;
L = [3, 10, 2, 5] ;
L = [3, 10, 5, 2] ;
?-
```

```
File Edit Settings Run Debug Help
question3b.pl - Assignment 3 - Visual Studio Code
question1.pl question3.pl question3b.pl
question3b.pl
1 powers_two(N,R):-
2   powers_two(N,1,R).
3
4 powers_two(0,R,R).
5
6 powers_two(N,P,R):-
7   P1 is P * 2,
8   N1 is N - 1,
9   powers_two(N1,P1,R).

```

```
SWI-Prolog -- c:\Github\Unisa\Logic Based Reasoning\Assignment 3\question3b.pl
File Edit Settings Run Debug Help
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For online help and background, visit http://www.swi-prolog.org
For built-in help, use ?- help(Topic). or ?- apropos(Word).
?- powers_two(5,R).
R = 32 ;
?-
```

QUESTION 4

QUESTION 5

```
question5.pl |
1 quicksort([], []).
2
3 quicksort([X|Tail], Sorted):-
4     split(X, Tail, Small, Big),
5     quicksort(Small, SortedSmall),
6     quicksort(Big, SortedBig),
7     conc( SortedSmall, [X|SortedBig], Sorted).
8
9 split( _ , [], [], []).
10
11 split( X, [Y|Tail], Small, Big):-
12     X = Y,!,
13     split(X,Tail, Small, Big).
14
15
16 split(X, [Y|Tail], [Y|Small], Big):-
17     X > Y,!,
18     split(X,Tail, Small, Big).
19
20 split(X, [Y|Tail], Small, [Y|Big]):-
21     split(X,Tail, Small, Big).
22
23
24 test(L):-
25     quicksort([2,5,9,2,5,8,10],L).
26
27 conc( [], X, X).
28 conc( [X | Y], Z, [X | W]) :- conc( Y, Z, W).
29
30 sameAsNext( _, []):-
31     fail.
32
33 sameAsNext(S, [H|_]) :-
34     S = H.
35
36 removeDuplicate([], []).
37
38
39 removeDuplicate([H|T], R):-
40     sameAsNext(H,T),!,
41     removeDuplicate( T, R1 ),
42     R = R1
43     ;
44     removeDuplicate( T, R1 ),
45     R = [H|R1].
46
```

SWI-Prolog -- c:/Github/Unisa/Logic Based Reasoning/Assignment 3/question5.pl
File Edit Settings Run Debug Help
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For online help and background, visit <http://www.swi-prolog.org>
For built-in help, use ?- help(Topic). or ?- apropos(Word).

?- quicksort([2,5,9,2,5,8,10],L).
L = [2, 5, 8, 9, 10].

?-

QUESTION 6

Starting off we have process 1 (P1) going to b and P2 going to c. The f value of P1 at b is $f(b) = 3 + 3 = 6$. And the f value of P2 at c is $f(c) = 3 + 4 = 7$. Since the f value of P1 is lower, P1 will continue to d and a new process named P3 will go from b to e.

Now for P1, $f(d) = 6 + 3 = 9$. For P3 $f(e) = 6 + 4 = 10$ and for P2 $f(c) = 7$. Now P2 will continue to e,

For P2 at e $f(e) = 7 + 4 = 11$. This is now larger than the f value for P1 at d which is 9 and P3 at e which is 10. Thus P1 continues and reaches the end goal at x.

