**Question 2.** A palindrome is a word that is the same whether read forwards or backwards. More precisely, let a palindrome be given as follows. The empty list is a palindrome. The lists [*a*] and [*b*] are palindromes. And if *L* is a palindrome then [*a*] · *L* · [*a*] and [*b*] · *L* · [*b*] are palindromes where “·” denotes concatenation of lists. For example,

[]*,*[*aa*]*,*[*bb*]*,*[*baab*]*,*[*abba*]*,*[*a*]*,*[*bab*]*,*[*aaa*]

are all palindromes.

1. Define a Prolog predicate palindrome(Xs) that recognises whether Xs is a palindrome.
2. Palindromes can be compressed by storing only ‘the first half’. We useterms compressed(odd, Zs) and compressed(even, Zs) to denote the compressed version of a palindrome. Define a predicate compress(Xs,C) that, for a palindrome Xs, unifies C with compressed(odd, Zs) or also compressed(even, Zs), depending on whether Xs is of odd or even length and where *Zs* is ‘the first half’ of Xs. For example,

?- compress([a,b,a,b,a], Z). Z = compressed(odd, [a, b, a]) ?- compress([a,b,b,a], Z).

Z = compressed(even, [a, b])

1. Define a predicate uncompress(C,Xs) that, for a compressed palindrome C as above, determines the uncompressed palindrome Xs.

**Question 3.** A domino is a rectangular tile with a number marked on either end, e.g.

|  |  |
| --- | --- |
| 6 | 4 |

Such a tile can be represented in Prolog as a term d(6,4). Note that the tile can be turned around so d(6,4) represents the same tile as d(4,6). A game of dominoes involves laying the tiles out so that the numbers on each match up, e.g.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 6 | 4 |  | 4 | 1 |  | 1 | 3 |

Write a program in Prolog to determine whether a selection of dominoes can be laid out in this way. For example, the following selection works

?- playout([d(2,6),d(0,4),d(2,4),d(1,3),d(1,6),d(0,1),d(4,4)]). true because they can be arranged

[d(1,0),d(0,4),d(4,4),d(4,2),d(2,6),d(6,1),d(1,3)] but the selection below does not work

?- playout([d(0,3),d(1,2),d(5,6),d(5,5),d(0,2),d(0,5),d(3,5)]). false.

Hint: use select to pick tiles recursively from the hand and maintain a note of the number at each end of the line.