Coursework 1 (part one): Downhill skiing

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Question 1

1	9	9	9
2	1	9	9
2	9	1	9
1	9	9	9

Because the algorithm does not look ahead, it has the potential of getting trapped by selecting a path where each arc has a very low cost at the beginning but increases significantly later on.

Question 2

$$D(x,y) = min(\{D(x-1,y+1), D(x,y+1), D(x+1,y+1)\}) + C(x,y) \quad (1)$$

$$D(x,n) = C(x,y) \quad (2)$$

$$D(x,y) = \infty \text{ if } x \notin [1,n] \quad (3)$$

C(x,y) returns the danger of moving a single step over *(x,y)*. This recurrence works by calculating the danger of 3 possible paths $(D(x-1,y+1), D(x,y+1), D(x+1,y+1))$ from the current position (x,y) to the bottom.

The least dangerous path is selected and added to the danger of using the current position in the path. This recurrence relation terminates when $y+1=n$ due to (2).

Question 3

```
Function D(x,y)
    dangers ← new integer [n][n]
    Function memoD(x,y)
        if x < 1 or x > n then
            return ∞
        else if y = n then
            return S[x][n]
        else if dangers[x][y] ≠ undefined then
            return dangers[x][y]
        else
            dangers[x][y] ← min({D(x − 1, y + 1), D(x, y + 1),
            D(x + 1, y + 1)}) + S[x][y]
            return dangers[x][y]
        end
    end
    return memoD(1,1)
end
```

Algorithm 1: Recursive dynamic programming algorithm to determine the danger of the least dangerous path