

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
end
return memoD(1,1)
```

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