



COURSE NAME: Algorithm Analysis

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HOMEWORK SUBJECT: Calculate the probability that a team with a winning rate of p in a game played by 2 different teams will receive a maximum of n wins in $2n + 1$ games.

Algorithm:

1. Necessary win count to win the game and winning ratio inputted from the user.
2. A square matrix has been created with a dimension of 1 more than the number of wins taken to store the winning and losing ratio.
3. First row filled with 1's for winning value, first column filled with 0's for losing value.
4. Elements in all remaining indices calculated with:
(winning ratio * cell above + losing ratio* cell left) formula.
5. When the entire matrix is filled, the last cell gives our calculated ratio value.

a-) Write the recurrence relation

$$M[i,j] = \begin{cases} \text{if}(i==0 \ \&\& \ j>0) \ \text{then} \ 1 \\ \text{else if}(i>0 \ \&\& \ j==0) \ \text{then} \ 0 \\ \text{otherwise} \\ M[i-1][j]*\text{ratio} + M[i][j-1]*(1-\text{ratio}) \end{cases}$$

b-) Calculate the probability of Team A winning in a series of 7 matches (4 fields win) when the probability of team A winning a match is 0.6.

$\times 0.6 \rightarrow$

	1	1	1	1
$\times 0.4$	0.6	0.34	0.94	0.97
	0.36	0.65	0.82	0.91
	0.22	0.48	0.68	0.82
	0.13	0.34	0.54	0.71

\leftarrow

$$\begin{aligned}
 M[1,1] &= 1 \text{ win in 1 game} = 0.4 \times 0 + 0.6 \times 1 = 0.6 \\
 M[1,2] &= 1 \text{ win in 2 game} = 0.6 \times 0.4 + 0.6 \times 1 = 0.84 \\
 M[1,3] &= 1 \text{ win in 3 game} = 0.84 \times 0.4 + 0.6 \times 1 = 0.94 \\
 M[1,4] &= 1 \text{ win in 4 game} = 0.94 \times 0.4 + 0.6 \times 1 = 0.97 \\
 M[2,2] &= 2 \text{ win in 2 game} = 0 \times 0.4 + 0.6 \times 0.6 = 0.36 \\
 M[2,3] &= 2 \text{ win in 3 game} = 0.36 \times 0.4 + 0.6 \times 0.84 = 0.65 \\
 M[2,4] &= 2 \text{ win in 4 game} = 0.65 \times 0.4 + 0.6 \times 0.94 = 0.82 \\
 M[2,5] &= 2 \text{ win in 5 game} = 0.82 \times 0.4 + 0.6 \times 0.97 = 0.91 \\
 M[3,3] &= 3 \text{ win in 3 game} = 0 \times 0.4 + 0.6 \times 0.36 = 0.22 \\
 M[3,4] &= 3 \text{ win in 4 game} = 0.22 \times 0.4 + 0.6 \times 0.65 = 0.48 \\
 M[3,5] &= 3 \text{ win in 5 game} = 0.48 \times 0.4 + 0.6 \times 0.82 = 0.68 \\
 M[3,6] &= 3 \text{ win in 6 game} = 0.68 \times 0.4 + 0.6 \times 0.91 = 0.82 \\
 M[4,4] &= 4 \text{ win in 4 game} = 0 \times 0.4 + 0.6 \times 0.22 = 0.13 \\
 M[4,5] &= 4 \text{ win in 5 game} = 0.13 \times 0.4 + 0.6 \times 0.48 = 0.34 \\
 M[4,6] &= 4 \text{ win in 6 game} = 0.13 \times 0.34 + 0.6 \times 0.68 = 0.54 \\
 M[4,7] &= 4 \text{ win in 7 game} = 0.13 \times 0.54 + 0.6 \times 0.82 = 0.71
 \end{aligned}$$

7 maalik seride

A takımı %60 ile kazanma

orandanda %71 ihtimalle

kazanır.

Screenshots:

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Win Ratio Calculator
Please enter required win count: 4
Please enter win ratio: 0.6
Winning ratio is 0.71.

Dynamic Programming Table:
0.00 1.00 1.00 1.00 1.00
0.00 0.60 0.84 0.94 0.97
0.00 0.36 0.65 0.82 0.91
0.00 0.22 0.48 0.68 0.82
0.00 0.13 0.34 0.54 0.71
  
```

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Win Ratio Calculator
Please enter required win count: 6
Please enter win ratio: 0.4
Winning ratio is 0.25.

Dynamic Programming Table:
0.00 1.00 1.00 1.00 1.00 1.00 1.00
0.00 0.40 0.64 0.78 0.87 0.92 0.95
0.00 0.16 0.35 0.52 0.66 0.77 0.84
0.00 0.06 0.18 0.32 0.46 0.58 0.68
0.00 0.03 0.09 0.18 0.29 0.41 0.52
0.00 0.01 0.04 0.10 0.17 0.27 0.37
0.00 0.00 0.02 0.05 0.10 0.17 0.25
  
```