Algoritmos_AG1

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1 Algoritmos - Actividad Guiada 1

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GitHub: https://github.com/osoria80/03MIAR-Algoritmos-de-optimizaci-n

1.1 Torres de Hanoi con Divide y vencerás

[1]:
```
#Situación inicial en el pilar 1
#Roja
#Amarilla
#Verde

# MEJORA: Indicar el colo de la ficha que se está moviendo.
## La ficha a mover viene dada por el valor de N.

piezas = ['Roja', 'Amarilla', 'Verde']

def Torres_Hanoi(N, desde, hasta):
  if N ==1 :
    print("Lleva la ficha ", piezas[N-1], "desde" ,desde , " hasta ", hasta )

  else:
    #Torres_Hanoi(N-1, desde, 6-desde-hasta )
    Torres_Hanoi(N-1, desde, 6-desde-hasta )
    print("Lleva la ficha ", piezas[N-1], "desde" ,desde , " hasta ", hasta )
    #Torres_Hanoi(N-1,6-desde-hasta, hasta )
    Torres_Hanoi(N-1, 6-desde-hasta  , hasta )


Torres_Hanoi(3, 1 , 3)

#Secuencia de llamadas
# Torres_Hanoi(3, 1 , 3)
# -> Torres_Hanoi(2, 1 , 2)
# -> -> Torres_Hanoi(1, 1 , 3) -> Roja de 1 a 3
# -> -> Print (2, 1 , 2)       -> Amarilla de 1 a 2
# -> -> Torres_Hanoi(1, 3 , 2) -> Roja de 3 a 2
```

```
# -> Print (2, 1 , 3)           -> Verde de 1 a 3
# -> Torres_Hanoi(2, 2 , 3)
# -> -> Torres_Hanoi(1, 2 , 1) -> Roja de 2 a 1
# -> -> Print (2, 2, 3)         -> Amarilla de 2 a 3
# -> -> Torres_Hanoi(1, 1 , 3) -> Roja de 1 a 3
```

```
Lleva la ficha  Roja desde 1  hasta  3
Lleva la ficha  Amarilla desde 1  hasta  2
Lleva la ficha  Roja desde 3  hasta  2
Lleva la ficha  Verde desde 1  hasta  3
Lleva la ficha  Roja desde 2  hasta  1
Lleva la ficha  Amarilla desde 2  hasta  3
Lleva la ficha  Roja desde 1  hasta  3
```

1.2 Sucesión de Fibonacci

[2]:
```
#Sucesión_de_Fibonacci
#https://es.wikipedia.org/wiki/Sucesi%C3%B3n_de_Fibonacci
#Calculo del termino n-simo de la suscesión de Fibonacci
def Fibonacci(N:int):
  if N < 2:
    return 1
  else:
    return Fibonacci(N-1)+Fibonacci(N-2)

Fibonacci(6)
```

[2]: 13

[3]:
```
# MEJORA: Sucesión de Fibonacci iterativa

def Fibonacci_iter(N:int):
    if N < 2:
        return 1

    a = 1
    b = 1

    for i in range(2,N+1):
        a, b = b, a+b

    return b

Fibonacci_iter(6)
```

[3]: 13

[4]:
```
%%time
print("Timepo de ejecución Fibonacci recursivo:")
Fibonacci(30)
```

```
Timepo de ejecución Fibonacci recursivo:
CPU times: total: 250 ms
Wall time: 234 ms
```

[4]: 1346269

[5]:
```
%%time
print("Timepo de ejecución Fibonacci iterativo:")
Fibonacci_iter(30)
```

```
Timepo de ejecución Fibonacci iterativo:
CPU times: total: 0 ns
Wall time: 241  s
```

[5]: 1346269

1.3 Devolución de cambio por técnica voraz

[6]:
```
def cambio_monedas(N, SM):
  SOLUCION = [0]*len(SM)    #SOLUCION = [0,0,0,0,..]
  ValorAcumulado = 0

  for i,valor in enumerate(SM):
    monedas =  (N-ValorAcumulado)//valor
    SOLUCION[i] = monedas
    ValorAcumulado = ValorAcumulado + monedas*valor

    if ValorAcumulado == N:
      return SOLUCION


cambio_monedas(15,[25,10,5,1])
```

[6]: [0, 1, 1, 0]

1.4 N-Reinas por técnica de vuelta atrás

[7]:
```
def escribe(S):
  n = len(S)
  for x in range(n):
    print("")
    for i in range(n):
      if S[i] == x+1:
        print(" X " , end="")
```

```
      else:
        print(" - ", end="")


def es_prometedora(SOLUCION,etapa):
  #print(SOLUCION)
  #Si la solución tiene dos valores iguales no es valida => Dos reinas en la misma fila
  for i in range(etapa+1):
    #print("El valor " + str(SOLUCION[i]) + " está " +  str(SOLUCION.count(SOLUCION[i])) + " veces")
    if SOLUCION.count(SOLUCION[i]) > 1:
      return False

    #Verifica las diagonales
    for j in range(i+1, etapa +1 ):
      #print("Comprobando diagonal de " + str(i) + " y " + str(j))
      if abs(i-j) == abs(SOLUCION[i]-SOLUCION[j]) : return False
  return True



def reinas(N, solucion=[], etapa=0):
  if len(solucion) == 0:
      solucion=[0 for i in range(N)]

  for i in range(1, N+1):
    solucion[etapa] = i

    if es_prometedora(solucion, etapa):
      if etapa == N-1:
        print(solucion)
        #escribe(solucion)
        print()
      else:
        reinas(N, solucion, etapa+1)
    else:
      None

    solucion[etapa] = 0

reinas(8)
```

```
[1, 5, 8, 6, 3, 7, 2, 4]

[1, 6, 8, 3, 7, 4, 2, 5]
```

[1, 7, 4, 6, 8, 2, 5, 3]

[1, 7, 5, 8, 2, 4, 6, 3]

[2, 4, 6, 8, 3, 1, 7, 5]

[2, 5, 7, 1, 3, 8, 6, 4]

[2, 5, 7, 4, 1, 8, 6, 3]

[2, 6, 1, 7, 4, 8, 3, 5]

[2, 6, 8, 3, 1, 4, 7, 5]

[2, 7, 3, 6, 8, 5, 1, 4]

[2, 7, 5, 8, 1, 4, 6, 3]

[2, 8, 6, 1, 3, 5, 7, 4]

[3, 1, 7, 5, 8, 2, 4, 6]

[3, 5, 2, 8, 1, 7, 4, 6]

[3, 5, 2, 8, 6, 4, 7, 1]

[3, 5, 7, 1, 4, 2, 8, 6]

[3, 5, 8, 4, 1, 7, 2, 6]

[3, 6, 2, 5, 8, 1, 7, 4]

[3, 6, 2, 7, 1, 4, 8, 5]

[3, 6, 2, 7, 5, 1, 8, 4]

[3, 6, 4, 1, 8, 5, 7, 2]

[3, 6, 4, 2, 8, 5, 7, 1]

[3, 6, 8, 1, 4, 7, 5, 2]

[3, 6, 8, 1, 5, 7, 2, 4]

[3, 6, 8, 2, 4, 1, 7, 5]

[3, 7, 2, 8, 5, 1, 4, 6]

[3, 7, 2, 8, 6, 4, 1, 5]

[3, 8, 4, 7, 1, 6, 2, 5]

[4, 1, 5, 8, 2, 7, 3, 6]

[4, 1, 5, 8, 6, 3, 7, 2]

[4, 2, 5, 8, 6, 1, 3, 7]

[4, 2, 7, 3, 6, 8, 1, 5]

[4, 2, 7, 3, 6, 8, 5, 1]

[4, 2, 7, 5, 1, 8, 6, 3]

[4, 2, 8, 5, 7, 1, 3, 6]

[4, 2, 8, 6, 1, 3, 5, 7]

[4, 6, 1, 5, 2, 8, 3, 7]

[4, 6, 8, 2, 7, 1, 3, 5]

[4, 6, 8, 3, 1, 7, 5, 2]

[4, 7, 1, 8, 5, 2, 6, 3]

[4, 7, 3, 8, 2, 5, 1, 6]

[4, 7, 5, 2, 6, 1, 3, 8]

[4, 7, 5, 3, 1, 6, 8, 2]

[4, 8, 1, 3, 6, 2, 7, 5]

[4, 8, 1, 5, 7, 2, 6, 3]

[4, 8, 5, 3, 1, 7, 2, 6]

[5, 1, 4, 6, 8, 2, 7, 3]

[5, 1, 8, 4, 2, 7, 3, 6]

[5, 1, 8, 6, 3, 7, 2, 4]

[5, 2, 4, 6, 8, 3, 1, 7]

[5, 2, 4, 7, 3, 8, 6, 1]

[5, 2, 6, 1, 7, 4, 8, 3]

[5, 2, 8, 1, 4, 7, 3, 6]

[5, 3, 1, 6, 8, 2, 4, 7]

[5, 3, 1, 7, 2, 8, 6, 4]

[5, 3, 8, 4, 7, 1, 6, 2]

[5, 7, 1, 3, 8, 6, 4, 2]

[5, 7, 1, 4, 2, 8, 6, 3]

[5, 7, 2, 4, 8, 1, 3, 6]

[5, 7, 2, 6, 3, 1, 4, 8]

[5, 7, 2, 6, 3, 1, 8, 4]

[5, 7, 4, 1, 3, 8, 6, 2]

[5, 8, 4, 1, 3, 6, 2, 7]

[5, 8, 4, 1, 7, 2, 6, 3]

[6, 1, 5, 2, 8, 3, 7, 4]

[6, 2, 7, 1, 3, 5, 8, 4]

[6, 2, 7, 1, 4, 8, 5, 3]

[6, 3, 1, 7, 5, 8, 2, 4]

[6, 3, 1, 8, 4, 2, 7, 5]

[6, 3, 1, 8, 5, 2, 4, 7]

[6, 3, 5, 7, 1, 4, 2, 8]

[6, 3, 5, 8, 1, 4, 2, 7]

[6, 3, 7, 2, 4, 8, 1, 5]

[6, 3, 7, 2, 8, 5, 1, 4]

```
[6, 3, 7, 4, 1, 8, 2, 5]

[6, 4, 1, 5, 8, 2, 7, 3]

[6, 4, 2, 8, 5, 7, 1, 3]

[6, 4, 7, 1, 3, 5, 2, 8]

[6, 4, 7, 1, 8, 2, 5, 3]

[6, 8, 2, 4, 1, 7, 5, 3]

[7, 1, 3, 8, 6, 4, 2, 5]

[7, 2, 4, 1, 8, 5, 3, 6]

[7, 2, 6, 3, 1, 4, 8, 5]

[7, 3, 1, 6, 8, 5, 2, 4]

[7, 3, 8, 2, 5, 1, 6, 4]

[7, 4, 2, 5, 8, 1, 3, 6]

[7, 4, 2, 8, 6, 1, 3, 5]

[7, 5, 3, 1, 6, 8, 2, 4]

[8, 2, 4, 1, 7, 5, 3, 6]

[8, 2, 5, 3, 1, 7, 4, 6]

[8, 3, 1, 6, 2, 5, 7, 4]

[8, 4, 1, 3, 6, 2, 7, 5]
```

1.5 Viaje por el rio. Programación dinámica

[8]:
```
TARIFAS = [
[0,5,4,3,999,999,999],
[999,0,999,2,3,999,11],
[999,999, 0,1,999,4,10],
[999,999,999, 0,5,6,9],
[999,999, 999,999,0,999,4],
[999,999, 999,999,999,0,3],
[999,999,999,999,999,999,0]
```

```
]



######################################################################
def Precios(TARIFAS):
######################################################################
  #Total de Nodos
  N = len(TARIFAS[0])

  #Inicialización de la tabla de precios
  PRECIOS = [ [9999]*N for i in [9999]*N]
  RUTA = [ [""]*N for i in [""]*N]

  for i in range(0,N-1):
    RUTA[i][i] = i              #Para ir de i a i se "pasa por i"
    PRECIOS[i][i] = 0           #Para ir de i a i se se paga 0
    for j in range(i+1, N):
      MIN = TARIFAS[i][j]
      RUTA[i][j] = i

      for k in range(i, j):
        if PRECIOS[i][k] + TARIFAS[k][j] < MIN:
            MIN = min(MIN, PRECIOS[i][k] + TARIFAS[k][j] )
            RUTA[i][j] = k          #Anota que para ir de i a j hay que pasar␣
 ↪por k
       PRECIOS[i][j] = MIN

  return PRECIOS,RUTA
######################################################################


PRECIOS,RUTA = Precios(TARIFAS)
#print(PRECIOS[0][6])

print("PRECIOS")
for i in range(len(TARIFAS)):
  print(PRECIOS[i])

print("\nRUTA")
for i in range(len(TARIFAS)):
  print(RUTA[i])

#Determinar la ruta con Recursividad
def calcular_ruta(RUTA, desde, hasta):
  if desde == hasta:
    #print("Ir a :" + str(desde))
```

```
    return ""
  else:
    return str(calcular_ruta( RUTA, desde, RUTA[desde][hasta])) +  \
                ',' + \
                str(RUTA[desde][hasta] \
              )

print("\nLa ruta es:")
calcular_ruta(RUTA, 0,6)
```

```
PRECIOS
[0, 5, 4, 3, 8, 8, 11]
[9999, 0, 999, 2, 3, 8, 7]
[9999, 9999, 0, 1, 6, 4, 7]
[9999, 9999, 9999, 0, 5, 6, 9]
[9999, 9999, 9999, 9999, 0, 999, 4]
[9999, 9999, 9999, 9999, 9999, 0, 3]
[9999, 9999, 9999, 9999, 9999, 9999, 9999]

RUTA
[0, 0, 0, 0, 1, 2, 5]
['', 1, 1, 1, 1, 3, 4]
['', '', 2, 2, 3, 2, 5]
['', '', '', 3, 3, 3, 3]
['', '', '', '', 4, 4, 4]
['', '', '', '', '', 5, 5]
['', '', '', '', '', '', '']

La ruta es:
```

[8]:
```
',0,2,5'
```

[10]:
```
!jupyter nbconvert --to pdf Algoritmos_AG1.ipynb
```

```
[NbConvertApp] Converting notebook Algoritmos_AG1.ipynb to pdf
[NbConvertApp] Writing 45909 bytes to notebook.tex
[NbConvertApp] Building PDF
[NbConvertApp] Running xelatex 3 times: ['xelatex', 'notebook.tex', '-quiet']
[NbConvertApp] Running bibtex 1 time: ['bibtex', 'notebook']
[NbConvertApp] WARNING | b had problems, most likely because there were no
citations
[NbConvertApp] PDF successfully created
[NbConvertApp] Writing 53456 bytes to Algoritmos_AG1.pdf
```