

# Algoritmos de Optimización - Actividad Guiada 3

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Enlace: [GitHub](#)

```
In [ ]: #Instalaciones de librerías

# Hacer llamadas http a paginas de la red
!pip install requests
# Modulo para las instancias del problema del TSP
!pip install tsplib95
```

```
In [1]: # Importaciones de librerías

import urllib.request #Hacer llamadas http a paginas de la red
import tsplib95        #Modulo para las instancias del problema del TSP
import math            #Modulo de funciones matematicas. Se usa para exp
import random          #Para generar valores aleatorios
import copy
```

## Actividad Guiada 3 - Parte 1

### Cargar los datos del problema

```
In [2]: #http://elib.zib.de/pub/mp-testdata/tsp/tsplib/
#Documentacion :
# http://comopt.ifl.uni-heidelberg.de/software/TSPLIB95/tsp95.pdf
# https://tsplib95.readthedocs.io/en/stable/pages/usage.html
# https://tsplib95.readthedocs.io/en/v0.6.1/modules.html
# https://pypi.org/project/tsplib95/

#Descargamos el fichero de datos(Matriz de distancias)
file = "swiss42.tsp" ;
urllib.request.urlretrieve("http://comopt.ifl.uni-heidelberg.de/software/TSPLIB95/t
#Descomprimir el fichero de datos
!"C:\Program Files (x86)\GnuWin32\bin\gzip" -d swiss42.tsp.gz

#Coorndas 51-city problem (Christofides/Eilon)
#file = "eil51.tsp" ; urllib.request.urlretrieve("http://comopt.ifl.uni-heidelberg.

#Coordenadas - 48 capitals of the US (Padberg/Rinaldi)
#file = "att48.tsp" ; urllib.request.urlretrieve("http://comopt.ifl.uni-heidelberg.
```

gzip: swiss42.tsp already exists; not overwritten

```
In [3]: #Carga de datos y generación de objeto problem
#####
```

```

problem = tsplib95.load(file)

#Nodos
Nodos = list(problem.get_nodes())

#Aristas
Aristas = list(problem.get_edges())
#print(Aristas)

NOMBRE: swiss42
TIPO: TSP
COMENTARIO: 42 Staedte Schweiz (Fricker)
DIMENSION: 42
EDGE_WEIGHT_TYPE: EXPLICIT
EDGE_WEIGHT_FORMAT: FULL_MATRIX
EDGE_WEIGHT_SECTION
0 15 30 23 32 55 33 37 92 114 92 110 96 90 74 76 82 72 78 82 159 122 131 206 112 57 28 43 70 1
15 0 34 23 27 40 19 32 93 117 88 100 87 75 63 67 71 69 62 63 96 164 132 131 212 106 44 33 5
30 34 0 11 18 57 36 65 62 84 64 89 76 93 95 100 104 98 57 88 99 130 100 101 179 86 51 4 18
23 23 11 0 11 48 26 54 70 94 69 75 75 84 84 89 92 89 54 78 99 141 111 109 89 89 11 11 11 54
32 27 18 11 0 40 20 58 67 92 61 78 65 76 83 89 91 95 43 72 110 141 116 105 190 81 34 19 35
55 40 57 48 40 0 23 55 96 123 78 75 36 36 66 66 63 95 34 34 137 174 156 129 224 90 15 59 75
33 19 36 26 20 23 0 45 85 111 75 82 69 60 63 70 71 85 44 52 115 161 136 122 210 91 25 37 54
37 32 65 54 58 55 45 0 124 149 118 126 113 80 42 42 40 40 87 87 94 158 158 163 242 135 65 6
92 93 62 70 67 96 85 124 0 28 29 68 63 122 148 155 156 159 67 129 148 78 80 39 129 46 82 65
114 117 84 94 92 123 111 149 28 0 54 91 88 150 174 181 182 181 95 157 159 50 65 27 102 65 11
92 88 64 69 61 78 75 118 29 54 0 39 34 99 134 142 141 157 44 110 161 103 109 52 154 22 63 6
110 100 89 89 78 75 82 126 68 91 39 0 14 80 129 139 135 167 39 98 187 136 148 81 186 28 61 9
96 87 76 75 65 62 69 113 63 88 34 14 0 72 117 128 124 153 26 88 174 136 142 82 187 32 48 79
90 75 93 84 76 36 60 80 122 150 99 80 72 0 59 71 63 116 56 25 170 201 189 151 252 104 44 95
74 63 95 84 83 56 63 42 148 174 134 129 117 59 0 11 8 63 93 35 135 223 195 184 273 146 71 9

```

In [4]: *#Probamos algunas funciones del objeto problem*

```

#Distancia entre nodos
problem.get_weight(0, 1)

#Todas las funciones
#Documentación: https://tsplib95.readthedocs.io/en/v0.6.1/modules.html

#dir(problem)

```

Out[4]: 15

## Funciones básicas

In [5]: *#Funcionas basicas*

```

#####

#Se genera una solucion aleatoria con comienzo en en el nodo 0
def crear_solucion(Nodos):
    solucion = [Nodos[0]]
    for n in Nodos[1:]:
        solucion = solucion + [random.choice(list(set(Nodos) - set({Nodos[0]}) - set(so
    return solucion

#Devuelve la distancia entre dos nodos
def distancia(a,b, problem):
    return problem.get_weight(a,b)

```

```

#Devuelve la distancia total de una trayectoria/solucion
def distancia_total(solucion, problem):
    distancia_total = 0
    for i in range(len(solucion)-1):
        distancia_total += distancia(solucion[i],solucion[i+1] , problem)
    return distancia_total + distancia(solucion[len(solucion)-1] ,solucion[0], problem)

sol_temporal = crear_solucion(Nodos)

distancia_total(sol_temporal, problem), sol_temporal

```

```

Out[5]: (4389,
        [0,
         14,
         1,
         23,
         39,
         40,
         28,
         13,
         16,
         8,
         33,
         17,
         20,
         10,
         5,
         31,
         2,
         19,
         37,
         7,
         38,
         22,
         30,
         29,
         36,
         32,
         4,
         9,
         18,
         3,
         12,
         6,
         15,
         11,
         35,
         24,
         34,
         27,
         26,
         21,
         25,
         41])

```

## Búsqueda aleatoria

```
In [6]: #####
# BUSQUEDA ALEATORIA
#####

def busqueda_aleatoria(problem, N):
    #N es el numero de iteraciones
    Nodos = list(problem.get_nodes())

    mejor_solucion = []
    #mejor_distancia = 10e100                                #Inicializamos con un valor alt
    mejor_distancia = float('inf')                          #Inicializamos con un valor alt

    for i in range(N):                                       #Criterio de parada: repetir N
        solucion = crear_solucion(Nodos)                    #Genera una solucion aleatoria
        distancia = distancia_total(solucion, problem)      #Calcula el valor objetivo(dist
        #Calcula el valor objetivo(distancia)

        if distancia < mejor_distancia:                    #Compara con la mejor obtenida
            mejor_solucion = solucion
            mejor_distancia = distancia

    print("Mejor solución:" , mejor_solucion)
    print("Distancia      :" , mejor_distancia)
    return mejor_solucion

#Busqueda aleatoria con 5000 iteraciones
solucion = busqueda_aleatoria(problem, 10000)
```

Mejor solución: [0, 4, 31, 32, 8, 41, 40, 30, 17, 37, 38, 18, 9, 26, 11, 10, 6, 12, 7, 25, 23, 28, 29, 20, 33, 24, 21, 39, 22, 34, 1, 35, 16, 13, 2, 5, 15, 27, 3, 19, 14, 36]

Distancia : 3604

## Búsqueda local

```
In [7]: #####
# BUSQUEDA LOCAL
#####

def genera_vecina(solucion):
    #Generador de soluciones vecinas: 2-opt (intercambiar 2 nodos) Si hay N nodos se
    #Se puede modificar para aplicar otros generadores distintos que 2-opt
    #print(solucion)
    mejor_solucion = []
    mejor_distancia = 10e100
    for i in range(1, len(solucion)-1):                      #Recorremos todos los nodos en bucle
        for j in range(i+1, len(solucion)):
            #Se genera una nueva solución intercambiando los dos nodos i,j:
            # (usamos el operador + que para listas en python las concatena) : ej.: [1,2
            vecina = solucion[:i] + [solucion[j]] + solucion[i+1:j] + [solucion[i]] + sol
```

```

#Se evalua la nueva solución ...
distancia_vecina = distancia_total(vecina, problem)

#... para guardarla si mejora las anteriores
if distancia_vecina <= mejor_distancia:
    mejor_distancia = distancia_vecina
    mejor_solucion = vecina
return mejor_solucion

#solucion = [1, 47, 13, 41, 40, 19, 42, 44, 37, 5, 22, 28, 3, 2, 29, 21, 50, 34, 30]
print("Distancia Solucion Inicial:" , distancia_total(solucion, problem))

nueva_solucion = genera_vecina(solucion)
print("Distancia Mejor Solucion Local:", distancia_total(nueva_solucion, problem))

```

Distancia Solucion Inicial: 3604

Distancia Mejor Solucion Local: 3381

```

In [8]: #Busqueda Local:
# - Sobre el operador de vecindad 2-opt(funcion genera_vecina)
# - Sin criterio de parada, se para cuando no es posible mejorar.
def busqueda_local(problem):
    mejor_solucion = []

    #Generar una solucion inicial de referencia(aleatoria)
    solucion_referencia = crear_solucion(Nodos)
    mejor_distancia = distancia_total(solucion_referencia, problem)

    iteracion=0          #Un contador para saber las iteraciones que hacemos
    while(1):
        iteracion +=1     #Incrementamos el contador
        #print('#',iteracion)

        #Obtenemos la mejor vecina ...
        vecina = genera_vecina(solucion_referencia)

        #... y la evaluamos para ver si mejoramos respecto a lo encontrado hasta el momento
        distancia_vecina = distancia_total(vecina, problem)

        #Si no mejoramos hay que terminar. Hemos llegado a un minimo local(según nuestro criterio)
        if distancia_vecina < mejor_distancia:
            #mejor_solucion = copy.deepcopy(vecina)    #Con copia profunda. Las copias en memoria son caras
            mejor_solucion = vecina                    #Guarda la mejor solución encontrada hasta el momento
            mejor_distancia = distancia_vecina

        else:
            print("En la iteracion ", iteracion, ", la mejor solución encontrada es:" , mejor_solucion)
            print("Distancia      :" , mejor_distancia)
            return mejor_solucion

    solucion_referencia = mejor_solucion

sol = busqueda_local(problem )

```

En la iteracion 39 , la mejor solución encontrada es: [0, 1, 6, 5, 26, 4, 3, 7, 31, 17, 37, 15, 16, 14, 19, 13, 12, 11, 25, 10, 2, 27, 20, 33, 34, 38, 22, 9, 23, 41, 18, 36, 35, 32, 28, 30, 29, 39, 21, 24, 40, 8]  
 Distancia : 1856

## Simulated Annealing

```
In [9]: #####
# SIMULATED ANNEALING
#####

#Generador de 1 solucion vecina 2-opt 100% aleatoria (intercambiar 2 nodos)
#Mejorable eligiendo otra forma de elegir una vecina.
def genera_vecina_aleatorio(solucion):

    #Se eligen dos nodos aleatoriamente
    i,j = sorted(random.sample( range(1,len(solucion)) , 2))

    #Devuelve una nueva solución pero intercambiando los dos nodos elegidos al azar
    return solucion[:i] + [solucion[j]] + solucion[i+1:j] + [solucion[i]] + solucion[

#Funcion de probabilidad para aceptar peores soluciones
def probabilidad(T,d):
    if random.random() < math.exp( -1*d / T) :
        return True
    else:
        return False

#Funcion de descenso de temperatura
def bajar_temperatura(T):
    return T*0.99
```

```
In [10]: def recocido_simulado(problem, TEMPERATURA ):
    #problem = datos del problema
    #T = Temperatura

    solucion_referencia = crear_solucion(Nodos)
    distancia_referencia = distancia_total(solucion_referencia, problem)

    mejor_solucion = []          #x* del pseudocodigo
    mejor_distancia = 10e100     #F* del pseudocodigo

    N=0
    while TEMPERATURA > .0001:
        N+=1
        #Genera una solución vecina
        vecina =genera_vecina_aleatorio(solucion_referencia)

        #Calcula su valor(distancia)
        distancia_vecina = distancia_total(vecina, problem)

        #Si es la mejor solución de todas se guarda(siempre!!!)
        if distancia_vecina < mejor_distancia:
```

```

        mejor_solucion = vecina
        mejor_distancia = distancia_vecina

        #Si la nueva vecina es mejor se cambia
        #Si es peor se cambia según una probabilidad que depende de T y delta(distancia)
        if distancia_vecina < distancia_referencia or probabilidad(TEMPERATURA, abs(distancia_vecina - distancia_referencia)) > 0:
            #solucion_referencia = copy.deepcopy(vecina)
            solucion_referencia = vecina
            distancia_referencia = distancia_vecina

        #Bajamos la temperatura
        TEMPERATURA = bajar_temperatura(TEMPERATURA)

    print("La mejor solución encontrada es " , end="")
    print(mejor_solucion)
    print("con una distancia total de " , end="")
    print(mejor_distancia)
    return mejor_solucion

sol = recocido_simulado(problem, 10000000)

```

La mejor solución encontrada es [0, 3, 27, 34, 33, 20, 7, 6, 4, 31, 36, 35, 17, 37, 15, 5, 26, 13, 14, 16, 19, 11, 18, 12, 25, 10, 8, 41, 23, 9, 29, 30, 32, 38, 24, 40, 21, 39, 22, 28, 2, 1]  
con una distancia total de 1840

## Actividad Guiada 3 - Parte 2

```

In [14]: #DATOS DEL PROBLEMA
file = "swiss42.tsp"
urllib.request.urlretrieve("http://comopt.ifi.uni-heidelberg.de/software/TSPLIB95/tsp/lib95/swiss42.tsp", file)

#Descomprimir el fichero de datos
! "C:\Program Files (x86)\GnuWin32\bin\gzip" -d swiss42.tsp.gz

problem = tsplib95.load(file)

#Nodos
Nodos = list(problem.get_nodes())

#Devuelve la distancia entre dos nodos
def distancia(a,b, problem):
    return problem.get_weight(a,b)

#Devuelve la distancia total de una trayectoria/solucion(lista de nodos)
def distancia_total(solucion, problem):
    distancia_total = 0
    for i in range(len(solucion)-1):
        distancia_total += distancia(solucion[i],solucion[i+1], problem)
    return distancia_total + distancia(solucion[len(solucion)-1],solucion[0], problem)

```

gzip: swiss42.tsp already exists; not overwritten

## Algoritmo de colonia de hormigas

La función Add\_Nodo selecciona al azar un nodo con probabilidad uniforme. Para ser mas eficiente debería seleccionar el próximo nodo siguiendo la probabilidad correspondiente a la ecuación:

$$p^{k_{ij}}(t) = \frac{[\tau_{ij}(t)]^{\alpha} [\nu_{ij}]^{\beta}}{\sum_{i \in J^k_i} [\tau_{il}]^{\alpha} [\nu_{il}]^{\beta}}, \text{ si } j \in J^k_i$$

$$p^{k_{ij}}(t) = 0, \text{ si } j \notin J^k_i$$

```
In [15]: def Add_Nodo(problem, H , T ) :
#Mejora:Establecer una funcion de probabilidad para
# añadir un nuevo nodo dependiendo de Los nodos mas cercanos y de Las feromonas d
Nodos = list(problem.get_nodes())
return random.choice( list(set(range(1,len(Nodos))) - set(H) ) )

def Incrementa_Feromona(problem, T, H ) :
#Incrementa segun la calidad de La solución. Añadir una cantidad inversamente pro
for i in range(len(H)-1):
    T[H[i]][H[i+1]] += 1000/distancia_total(H, problem)
return T

def Evaporar_Feromonas(T ):
#Evapora 0.3 el valor de La feromona, sin que baje de 1
#Mejora:Podemos elegir diferentes funciones de evaporación dependiendo de La cant
T = [[ max(T[i][j] - 0.3 , 1) for i in range(len(Nodos)) ] for j in range(len(Nod
return T
```

```
In [17]: def hormigas(problem, N) :
#problem = datos del problema
#N = Número de agentes(hormigas)

#Nodos
Nodos = list(problem.get_nodes())
#Aristas
Aristas = list(problem.get_edges())

#Inicializa Las aristas con una cantidad inicial de feromonas:1
#Mejora: inicializar con valores diferentes dependiendo diferentes criterios
T = [[ 1 for _ in range(len(Nodos)) ] for _ in range(len(Nodos))]

#Se generan Los agentes(hormigas) que serán estructuras de caminos desde 0
Hormiga = [[0] for _ in range(N)]

#Recorre cada agente construyendo La solución
for h in range(N) :
    #Para cada agente se construye un camino
    for i in range(len(Nodos)-1) :

        #Elige el siguiente nodo
        Nuevo_Nodo = Add_Nodo(problem, Hormiga[h] , T )
        Hormiga[h].append(Nuevo_Nodo)

    #Incrementa feromonas en esa arista
    T = Incrementa_Feromona(problem, T, Hormiga[h] )
```



```

#Print("Feromonas(1)", T)

#Evapora Feromonas
T = Evaporar_Feromonas(T)
#Print("Feromonas(2)", T)

#Seleccionamos el mejor agente
mejor_solucion = []
mejor_distancia = 10e100
for h in range(N) :
    distancia_actual = distancia_total(Hormiga[h], problem)
    if distancia_actual < mejor_distancia:
        mejor_solucion = Hormiga[h]
        mejor_distancia = distancia_actual

print(mejor_solucion)
print(mejor_distancia)

hormigas(problem, 1000)

```

```

[0, 4, 23, 28, 13, 26, 3, 20, 32, 14, 34, 22, 41, 9, 33, 31, 36, 35, 19, 6, 7, 29,
1, 17, 38, 12, 27, 15, 10, 24, 21, 8, 39, 40, 5, 2, 16, 25, 18, 30, 11, 37]
4017

```

## Actividad Propuesta - Parte 1

### Carga de datos del problema

```

In [2]: file = "swiss42.tsp" ;
urllib.request.urlretrieve("http://comopt.ifi.uni-heidelberg.de/software/TSPLIB95/t
#Descomprimir el fichero de datos
!"C:\Program Files (x86)\GnuWin32\bin\gzip" -d swiss42.tsp.gz

#Objeto de tsplib95 para nuestro problema problema
problem = tsplib95.load(file)

#Nodos
Nodos = list(problem.get_nodes())

#Aristas
Aristas = list(problem.get_edges())
#print(Aristas)

#Coordenadas(si estan disponibles en el fichero)
problem.get_display(1)

#Distancia
problem.get_weight(1, 2)

```

gzip: swiss42.tsp already exists; not overwritten

Out[2]: 34

## Funciones de la Actividad Guiada 3

```
In [3]: #Funciones de La Actividad Guiada 3
#Se genera una solucion aleatoria con comienzo en el nodo 0
def crear_solucion(Nodos):
    solucion = [Nodos[0]]
    for n in Nodos[1:] :
        solucion = solucion + [random.choice(list(set(Nodos) - set(solucion)))]
    return solucion

#Devuelve la distancia entre dos nodos
def distancia(a, b, problem):
    return problem.get_weight(a,b)

#Devuelve la distancia total de una trayectoria/solucion
def distancia_total(solucion, problem):
    distancia_total = 0
    for i in range(len(solucion)-1):
        distancia_total += distancia(solucion[i],solucion[i+1] , problem)
    return distancia_total + distancia(solucion[len(solucion)-1],solucion[0], prob
```

## Funciones Auxiliares

```
In [4]: # Genera una poblacion inicial de soluciones de tamaño N.
# Puede ser válida la solución aleatoria de la AG3: crear_solucion(Nodos)
def generar_poblacion(Nodos, N):
    return [crear_solucion(Nodos) for _ in range(N)]
```

```
In [5]: #Evalua la población y devuelve el mejor individuo
def Evaluar_Poblacion(poblacion, problem):
    mejor_solucion = None
    mejor_distancia = float('inf')

    for p in poblacion:
        distancia_solucion = distancia_total(p, problem)
        if distancia_solucion < mejor_distancia:
            mejor_distancia = distancia_solucion
            mejor_solucion = p

    return mejor_solucion, mejor_distancia
```

```
In [6]: #Funcion de cruce. Recibe una poblacion(Lista de soluciones) y devuelve la població
# Todos los individuos de la población son seleccionados para el cruce (si la poblac
# Podría aplicarse un proceso previo de selección para elegir los individuos que se
def Cruzar(poblacion, mutacion, problem):
    nueva_poblacion = poblacion.copy()
    for i in range(0, len(poblacion), 2):
        if i + 1 < len(poblacion):
            padre1 = poblacion[i]
            padre2 = poblacion[i + 1]
            hijos = Descendencia([padre1, padre2], problem, mutacion)
            nueva_poblacion.extend(hijos)
    return nueva_poblacion
```

```
In [13]: #Funcion para generar hijos a partir de 2 padres:
# Se elige el metodo de 1-punto de corte pero es posible usar otros n-puntos, unifo
def Descendencia(padres, problem, mutacion):
    punto_corte = random.randint(1, len(padres[0]) - 1)

    hijo1 = padres[0][:punto_corte] + padres[1][punto_corte:]
    hijo2 = padres[1][:punto_corte] + padres[0][punto_corte:]

    hijo1 = Factibilizar(hijo1, problem)
    hijo2 = Factibilizar(hijo2, problem)

    return [hijo1, hijo2, Mutar(hijo1, mutacion), Mutar(hijo2, mutacion)]
```

```
In [8]: #Para el operador de cruce 1-punto los hijos generados no son soluciones(algunos no
def Factibilizar(solucion, problem):
    nodos_totales = set(problem.get_nodes())
    nodos_faltantes = list(nodos_totales - set(solucion))

    # Contar las ocurrencias de cada nodo en la solución
    conteo_nodos = {nodo: solucion.count(nodo) for nodo in solucion}

    solucion_factible = []
    for nodo in solucion:
        if conteo_nodos[nodo] > 1:
            conteo_nodos[nodo] -= 1
            solucion_factible.append(nodos_faltantes.pop(0))
        else:
            solucion_factible.append(nodo)

    # Si aún hay nodos faltantes, añadirlos a la solución factible
    if nodos_faltantes:
        for i in range(len(solucion_factible)):
            if solucion_factible.count(solucion_factible[i]) > 1:
                solucion_factible[i] = nodos_faltantes.pop(0)
                if not nodos_faltantes:
                    break

    return solucion_factible
```

```
In [9]: #Funcion de mutación. Se eligen dos nodos y se intercambia. Se podrian añadir otros
# Se hace mutaciones mutacion% de las veces
def Mutar(solucion, mutacion):
    if random.random() < mutacion:
        idx1, idx2 = random.sample(range(len(solucion)), 2)
        solucion[idx1], solucion[idx2] = solucion[idx2], solucion[idx1] # Intercamb
    return solucion
```

```
In [10]: #Funcion de seleccion de la población. Recibe como parametro una poblacion y
# devuelve una poblacion a la que se ha eliminado individuos poco aptos(fitness alt
#Se tiene en cuenta el porcentaje elitismo pasado como parametro
# Para los individuos que no son de la elite podríamos usar una selección de ruleta
def Seleccionar(problem, poblacion, N, elitismo):
    evaluaciones = [(p, distancia_total(p, problem)) for p in poblacion]
    evaluaciones.sort(key=lambda x: x[1])
```

```

elite_size = int(elitismo * N)
elite = [evaluacion[0] for evaluacion in evaluaciones[:elite_size]]

fitness_totales = sum(1 / evaluacion[1] for evaluacion in evaluaciones[elite_si

seleccionados = elite.copy()
while len(seleccionados) < N:
    pick = random.uniform(0, fitness_totales)
    current = 0
    for solucion, distancia in evaluaciones[elite_size:]:
        current += 1 / distancia
        if current > pick:
            seleccionados.append(solucion)
            break

return seleccionados

```

```

In [15]: # Parámetros
N = 500
mutacion = 0.3
elitismo = 0.4
generaciones = 250 # Número de generaciones a iterar

# Generar la población inicial
Nodos = list(problem.get_nodes())
poblacion = generar_poblacion(Nodos, N)

#print("\nPoblación inicial:")
#for i, solucion in enumerate(poblacion):
#    print(f'Población {i+1}: {solucion}')

# Evaluar la población y encontrar el mejor individuo
mejor_solucion, mejor_distancia = Evaluar_Poblacion(poblacion, problem)

# Bucle evolutivo
for generacion in range(generaciones+1):
    # Aplicar el cruce a la población
    nueva_poblacion = Cruzar(poblacion, mutacion, problem)

    # Seleccionar la nueva población
    poblacion = Seleccionar(problem, nueva_poblacion, N, elitismo)
    # Imprimir la nueva población
    #for i, solucion in enumerate(poblacion):
    #    print(f'Población {i+1}: {solucion}')

    mejor_solucion, mejor_distancia = Evaluar_Poblacion(poblacion, problem)
    #print(f'\nGeneración {generacion+1}:')
    #print('Mejor solución: ', mejor_solucion)
    #print('Distancia total de la mejor solución: ', mejor_distancia)

# Evaluar la población final y encontrar el mejor individuo
mejor_solucion, mejor_distancia = Evaluar_Poblacion(poblacion, problem)
print('\nMejor solución después del cruce y selección: ', mejor_solucion)
print('Distancia total de la mejor solución: ', mejor_distancia)

```

Mejor solución después del cruce y selección: [1, 0, 3, 2, 8, 41, 25, 11, 12, 13, 1  
9, 16, 14, 5, 9, 23, 40, 24, 21, 39, 22, 38, 30, 27, 4, 6, 26, 18, 10, 29, 28, 36, 3  
5, 20, 33, 34, 32, 31, 17, 37, 15, 7]  
Distancia total de la mejor solución: 1772

```
In [11]: def algoritmo_genetico(problem=problem, N=100, mutacion=0.15, elitismo=0.1, generac
        Nodos = list(problem.get_nodes())
        poblacion = generar_poblacion(Nodos, N)
        (mejor_solucion, mejor_distancia) = Evaluar_Poblacion(poblacion, problem)
        parar = False
        n=0
        while(not parar):
            poblacion = Cruzar(poblacion, mutacion, problem)
            poblacion = Seleccionar(problem, poblacion, N, elitismo)
            (mejor_solucion, mejor_distancia) = Evaluar_Poblacion(poblacion, problem)
            print(f'\nGeneración {n}. \n La mejor solución es: {mejor_solucion}. \n Con
            if n==generaciones:
                parar=True
            n += 1
        return n, mejor_solucion, mejor_distancia
```

```
In [14]: n, mejor_solucion, mejor_distancia = algoritmo_genetico(problem=problem, N=500, mut
        print(f'\nGeneración {n}. \n La mejor solución es: {mejor_solucion}. \n Con distanc
```

## Generación 0.

La mejor solución es: [0, 20, 27, 18, 10, 29, 4, 25, 3, 28, 38, 39, 15, 37, 34, 22, 24, 40, 11, 30, 36, 9, 31, 35, 33, 6, 8, 17, 14, 16, 2, 5, 13, 7, 1, 19, 32, 23, 21, 26, 12, 41].

Con distancia 3913.

## Generación 1.

La mejor solución es: [0, 20, 27, 18, 10, 29, 4, 25, 3, 28, 38, 39, 15, 37, 34, 22, 24, 40, 11, 30, 36, 9, 31, 35, 33, 6, 8, 17, 14, 16, 2, 5, 13, 7, 1, 19, 32, 23, 21, 26, 12, 41].

Con distancia 3913.

## Generación 2.

La mejor solución es: [0, 1, 33, 34, 37, 15, 6, 10, 12, 21, 22, 23, 24, 38, 29, 35, 14, 9, 30, 25, 4, 5, 27, 7, 17, 16, 36, 13, 11, 20, 18, 40, 8, 19, 26, 41, 39, 3, 3, 1, 28, 32, 2].

Con distancia 3837.

## Generación 3.

La mejor solución es: [0, 33, 34, 37, 17, 35, 36, 39, 10, 3, 7, 8, 38, 26, 9, 41, 1, 8, 14, 19, 40, 22, 20, 28, 29, 25, 13, 16, 1, 27, 24, 21, 23, 12, 11, 31, 15, 6, 30, 5, 4, 32, 2].

Con distancia 3611.

## Generación 4.

La mejor solución es: [0, 1, 4, 5, 37, 16, 10, 11, 2, 14, 36, 35, 17, 38, 25, 39, 6, 33, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 40, 29, 30, 34, 9, 28, 22, 24, 8, 23, 2, 1, 26, 12, 41].

Con distancia 3524.

## Generación 5.

La mejor solución es: [0, 1, 4, 5, 37, 16, 10, 11, 2, 14, 36, 35, 17, 38, 25, 39, 6, 33, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 40, 29, 30, 34, 9, 28, 22, 24, 8, 23, 2, 1, 26, 12, 41].

Con distancia 3524.

## Generación 6.

La mejor solución es: [0, 1, 4, 5, 37, 16, 10, 11, 2, 14, 36, 35, 17, 29, 25, 39, 6, 33, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 40, 38, 30, 34, 9, 28, 22, 24, 8, 23, 2, 1, 26, 12, 41].

Con distancia 3473.

## Generación 7.

La mejor solución es: [0, 1, 4, 5, 37, 16, 10, 11, 2, 14, 36, 35, 17, 38, 25, 39, 6, 33, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 34, 9, 28, 22, 24, 40, 23, 2, 1, 26, 12, 41].

Con distancia 3302.

## Generación 8.

La mejor solución es: [0, 1, 4, 5, 37, 16, 10, 11, 2, 14, 36, 35, 17, 38, 25, 18, 6, 33, 27, 3, 19, 13, 7, 15, 31, 20, 32, 39, 40, 29, 30, 34, 9, 28, 22, 24, 8, 23, 2, 1, 26, 12, 41].

Con distancia 3285.

## Generación 9.

La mejor solución es: [0, 1, 4, 5, 37, 16, 10, 11, 2, 14, 36, 35, 17, 38, 25, 18,

6, 33, 27, 3, 19, 13, 7, 15, 31, 20, 32, 39, 40, 29, 30, 34, 9, 28, 22, 24, 8, 23, 21, 26, 12, 41].

Con distancia 3285.

Generación 10.

La mejor solución es: [0, 1, 4, 5, 37, 16, 10, 11, 2, 14, 36, 35, 17, 38, 25, 18, 6, 33, 27, 3, 19, 13, 7, 15, 31, 20, 32, 39, 40, 29, 30, 34, 9, 28, 22, 24, 8, 23, 21, 26, 12, 41].

Con distancia 3285.

Generación 11.

La mejor solución es: [0, 3, 4, 5, 37, 16, 10, 11, 2, 14, 36, 35, 17, 18, 25, 39, 34, 33, 27, 1, 19, 13, 7, 15, 31, 20, 32, 38, 40, 29, 30, 6, 9, 28, 22, 24, 8, 23, 21, 26, 12, 41].

Con distancia 3197.

Generación 12.

La mejor solución es: [0, 1, 4, 5, 37, 16, 26, 11, 2, 14, 36, 35, 17, 38, 25, 39, 6, 33, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 34, 9, 28, 22, 24, 40, 23, 21, 10, 12, 41].

Con distancia 3190.

Generación 13.

La mejor solución es: [0, 1, 4, 5, 37, 16, 10, 11, 2, 14, 36, 35, 17, 38, 39, 25, 6, 33, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 34, 9, 28, 22, 24, 40, 23, 21, 26, 12, 41].

Con distancia 3164.

Generación 14.

La mejor solución es: [0, 1, 4, 5, 37, 16, 10, 11, 2, 14, 36, 35, 17, 38, 21, 39, 6, 33, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 9, 34, 22, 24, 40, 23, 25, 26, 12, 41].

Con distancia 3048.

Generación 15.

La mejor solución es: [0, 1, 4, 5, 37, 16, 10, 11, 2, 14, 36, 35, 17, 38, 25, 18, 6, 33, 27, 3, 19, 13, 7, 15, 31, 20, 32, 39, 8, 29, 30, 34, 9, 28, 22, 24, 40, 23, 21, 41, 12, 26].

Con distancia 3020.

Generación 16.

La mejor solución es: [0, 1, 4, 5, 37, 16, 10, 11, 2, 14, 36, 35, 17, 38, 25, 18, 6, 33, 27, 3, 19, 13, 7, 15, 31, 20, 32, 39, 8, 29, 30, 34, 9, 28, 22, 24, 40, 23, 21, 41, 12, 26].

Con distancia 3020.

Generación 17.

La mejor solución es: [0, 1, 4, 5, 37, 16, 10, 11, 2, 14, 36, 35, 17, 38, 25, 18, 6, 33, 27, 3, 19, 13, 7, 15, 31, 20, 32, 39, 8, 29, 30, 34, 9, 28, 22, 24, 40, 23, 21, 41, 12, 26].

Con distancia 3020.

Generación 18.

La mejor solución es: [0, 1, 4, 5, 15, 16, 10, 11, 2, 14, 36, 35, 17, 38, 21, 39, 6, 33, 34, 3, 19, 13, 7, 37, 31, 20, 32, 18, 8, 29, 30, 27, 9, 28, 22, 24, 40, 23, 25, 26, 12, 41].

Con distancia 2924.

Generación 19.

La mejor solución es: [0, 1, 4, 5, 15, 16, 10, 11, 2, 14, 36, 35, 17, 38, 21, 39, 6, 33, 34, 3, 19, 13, 7, 37, 31, 20, 32, 18, 8, 29, 30, 27, 9, 28, 22, 24, 40, 23, 25, 26, 12, 41].

Con distancia 2924.

Generación 20.

La mejor solución es: [0, 1, 2, 5, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 4, 33, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 9, 34, 22, 24, 40, 23, 25, 26, 12, 41].

Con distancia 2841.

Generación 21.

La mejor solución es: [0, 1, 4, 5, 37, 16, 41, 11, 9, 14, 36, 35, 17, 8, 25, 18, 6, 32, 27, 26, 19, 13, 7, 15, 31, 20, 33, 39, 38, 29, 30, 28, 2, 34, 22, 24, 40, 23, 21, 10, 12, 3].

Con distancia 2821.

Generación 22.

La mejor solución es: [0, 1, 2, 5, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 4, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 12, 41].

Con distancia 2697.

Generación 23.

La mejor solución es: [0, 1, 2, 5, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 4, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 12, 41].

Con distancia 2697.

Generación 24.

La mejor solución es: [0, 1, 2, 5, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 4, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 12, 41].

Con distancia 2697.

Generación 25.

La mejor solución es: [0, 1, 2, 5, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 4, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 12, 41].

Con distancia 2697.

Generación 26.

La mejor solución es: [0, 1, 2, 4, 10, 11, 5, 14, 16, 37, 36, 35, 17, 38, 21, 39, 6, 33, 34, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 27, 9, 41, 22, 24, 40, 23, 25, 26, 12, 28].

Con distancia 2660.

Generación 27.

La mejor solución es: [0, 1, 2, 4, 10, 11, 5, 14, 16, 37, 36, 35, 17, 38, 21, 39, 6, 33, 34, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 27, 9, 41, 22, 24, 40, 23, 25, 26, 12, 28].

Con distancia 2660.



Generación 28.

La mejor solución es: [0, 1, 2, 5, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 4, 1, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 2, 5, 26, 12, 4].

Con distancia 2505.

Generación 29.

La mejor solución es: [0, 1, 2, 5, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 4, 1, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 2, 5, 26, 12, 4].

Con distancia 2505.

Generación 30.

La mejor solución es: [0, 1, 2, 5, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 4, 1, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 2, 5, 26, 12, 4].

Con distancia 2505.

Generación 31.

La mejor solución es: [0, 1, 2, 12, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 41, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2422.

Generación 32.

La mejor solución es: [0, 1, 2, 12, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 41, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2422.

Generación 33.

La mejor solución es: [0, 1, 2, 12, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 41, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2422.

Generación 34.

La mejor solución es: [0, 1, 2, 12, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 41, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2422.

Generación 35.

La mejor solución es: [0, 1, 2, 12, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 41, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2422.

Generación 36.

La mejor solución es: [0, 1, 2, 12, 10, 11, 6, 7, 16, 37, 36, 35, 17, 38, 21, 39, 4, 1, 9, 27, 3, 19, 13, 14, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2393.

Generación 37.

La mejor solución es: [0, 1, 2, 5, 26, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 2,

3, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 4].

Con distancia 2368.

Generación 38.

La mejor solución es: [0, 1, 2, 12, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 9, 41, 27, 3, 19, 13, 15, 7, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2365.

Generación 39.

La mejor solución es: [0, 1, 2, 12, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 9, 41, 27, 3, 19, 13, 15, 7, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2365.

Generación 40.

La mejor solución es: [0, 1, 2, 12, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 9, 41, 27, 3, 19, 13, 15, 7, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2365.

Generación 41.

La mejor solución es: [0, 1, 2, 10, 12, 11, 6, 14, 16, 15, 36, 35, 17, 38, 21, 39, 41, 18, 27, 3, 19, 13, 7, 37, 31, 20, 32, 9, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2345.

Generación 42.

La mejor solución es: [0, 1, 2, 11, 26, 5, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 23, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 4].

Con distancia 2341.

Generación 43.

La mejor solución es: [0, 1, 18, 12, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 9, 41, 27, 3, 19, 13, 15, 7, 31, 20, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2282.

Generación 44.

La mejor solución es: [0, 1, 18, 12, 10, 11, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 9, 41, 27, 3, 19, 13, 15, 7, 31, 20, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2282.

Generación 45.

La mejor solución es: [0, 1, 2, 4, 26, 5, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 23, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 11].

Con distancia 2270.

Generación 46.

La mejor solución es: [0, 1, 2, 4, 26, 5, 6, 14, 16, 37, 36, 35, 17, 38, 21, 39, 23, 9, 27, 3, 19, 13, 7, 15, 31, 20, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 11].

Con distancia 2270.

Generación 47.

La mejor solución es: [0, 1, 18, 26, 5, 11, 6, 14, 16, 37, 36, 35, 17, 38, 39, 21, 9, 23, 27, 3, 19, 13, 15, 7, 31, 20, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 4].

Con distancia 2259.

Generación 48.

La mejor solución es: [0, 1, 18, 26, 5, 11, 6, 14, 16, 37, 36, 35, 17, 38, 39, 21, 9, 23, 27, 3, 19, 13, 15, 7, 31, 20, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 4].

Con distancia 2259.

Generación 49.

La mejor solución es: [0, 1, 2, 10, 12, 11, 6, 15, 16, 37, 36, 35, 20, 38, 21, 39, 9, 41, 27, 3, 19, 13, 14, 7, 31, 17, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2256.

Generación 50.

La mejor solución es: [0, 1, 2, 10, 12, 11, 6, 15, 16, 37, 36, 35, 20, 38, 21, 39, 9, 41, 27, 3, 19, 13, 14, 7, 31, 17, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2256.

Generación 51.

La mejor solución es: [0, 1, 2, 10, 12, 11, 18, 15, 16, 37, 36, 35, 20, 38, 21, 39, 9, 41, 27, 3, 19, 13, 14, 7, 31, 17, 32, 6, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2231.

Generación 52.

La mejor solución es: [0, 1, 2, 10, 12, 11, 18, 15, 16, 37, 36, 35, 20, 38, 21, 39, 9, 41, 27, 3, 19, 13, 14, 7, 31, 17, 32, 6, 8, 29, 30, 28, 33, 34, 22, 24, 40, 23, 25, 26, 5, 4].

Con distancia 2231.

Generación 53.

La mejor solución es: [0, 1, 2, 26, 4, 5, 6, 15, 16, 37, 36, 35, 20, 38, 21, 39, 9, 23, 27, 3, 19, 13, 14, 7, 31, 17, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 11].

Con distancia 2222.

Generación 54.

La mejor solución es: [0, 1, 18, 26, 5, 11, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 27, 3, 19, 13, 15, 7, 31, 17, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 4].

Con distancia 2189.

Generación 55.

La mejor solución es: [0, 1, 18, 26, 5, 11, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 27, 3, 19, 13, 15, 7, 31, 17, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 4].

Con distancia 2189.

Generación 56.

La mejor solución es: [0, 1, 18, 26, 5, 11, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 27, 3, 19, 13, 15, 7, 31, 17, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 4].

Con distancia 2189.

Generación 57.

La mejor solución es: [0, 1, 18, 26, 5, 4, 6, 14, 16, 37, 36, 35, 31, 38, 39, 21, 9, 23, 27, 3, 19, 13, 15, 7, 17, 20, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 11].

Con distancia 2174.

Generación 58.

La mejor solución es: [0, 1, 2, 4, 26, 5, 6, 15, 16, 37, 36, 35, 20, 38, 21, 39, 9, 23, 27, 3, 19, 13, 14, 7, 31, 17, 32, 18, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 11].

Con distancia 2164.

Generación 59.

La mejor solución es: [0, 1, 18, 11, 26, 5, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 27, 3, 19, 13, 15, 7, 31, 17, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 4].

Con distancia 2132.

Generación 60.

La mejor solución es: [0, 1, 18, 26, 5, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 27, 3, 19, 13, 15, 7, 31, 17, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 11].

Con distancia 2119.

Generación 61.

La mejor solución es: [0, 1, 18, 26, 5, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 27, 3, 19, 13, 15, 7, 31, 17, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 11].

Con distancia 2119.

Generación 62.

La mejor solución es: [0, 1, 18, 26, 5, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 27, 3, 19, 13, 15, 7, 31, 17, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 11].

Con distancia 2119.

Generación 63.

La mejor solución es: [0, 1, 18, 26, 5, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 27, 3, 19, 13, 15, 7, 31, 17, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 11].

Con distancia 2119.

Generación 64.

La mejor solución es: [0, 1, 18, 26, 5, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 23, 9, 27, 3, 19, 13, 15, 7, 31, 17, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 11].

Con distancia 2109.

Generación 65.

La mejor solución es: [0, 1, 18, 26, 5, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21,

9, 23, 27, 3, 19, 13, 15, 7, 31, 17, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 2107.

Generación 66.

La mejor solución es: [0, 1, 5, 26, 18, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 27, 3, 19, 13, 15, 7, 31, 17, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 11].

Con distancia 2100.

Generación 67.

La mejor solución es: [0, 1, 4, 18, 26, 5, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 27, 3, 19, 13, 15, 7, 31, 17, 32, 2, 8, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 11].

Con distancia 2090.

Generación 68.

La mejor solución es: [0, 1, 18, 26, 5, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 19, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 2047.

Generación 69.

La mejor solución es: [0, 1, 18, 26, 5, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 19, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 2047.

Generación 70.

La mejor solución es: [0, 1, 18, 26, 5, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 19, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 2047.

Generación 71.

La mejor solución es: [0, 1, 18, 26, 5, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 19, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 2047.

Generación 72.

La mejor solución es: [0, 1, 18, 26, 5, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 19, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 2047.

Generación 73.

La mejor solución es: [18, 1, 0, 26, 5, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 19, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 11].

Con distancia 2022.

Generación 74.

La mejor solución es: [18, 1, 0, 26, 5, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 19, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 10, 12, 11].

Con distancia 2022.

Generación 75.

La mejor solución es: [0, 1, 4, 18, 26, 5, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 19, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 2018.

Generación 76.

La mejor solución es: [0, 1, 4, 18, 26, 5, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 19, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 2018.

Generación 77.

La mejor solución es: [18, 1, 0, 26, 3, 4, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 23, 9, 8, 5, 19, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 2011.

Generación 78.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 6, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1984.

Generación 79.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 6, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1984.

Generación 80.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 6, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1984.

Generación 81.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 6, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1984.

Generación 82.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 6, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1984.

Generación 83.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 6, 13, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1984.

Generación 84.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 6, 13, 15, 7, 31, 17, 32, 2, 27, 29, 28, 30, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1979.

Generación 85.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 13, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 6, 14, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1972.

Generación 86.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 13, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 6, 14, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1972.

Generación 87.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 13, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 6, 14, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1972.

Generación 88.

La mejor solución es: [4, 1, 0, 18, 26, 5, 19, 13, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 3, 6, 14, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1970.

Generación 89.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 13, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 3, 6, 14, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1962.

Generación 90.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 13, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 3, 6, 14, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1962.

Generación 91.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 13, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 3, 6, 14, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1962.

Generación 92.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 13, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 3, 6, 14, 15, 7, 31, 17, 32, 2, 27, 29, 30, 28, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1962.

Generación 93.

La mejor solución es: [0, 1, 4, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9,

23, 8, 18, 13, 19, 15, 7, 17, 31, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1936.

Generación 94.

La mejor solución es: [0, 1, 4, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1936.

Generación 95.

La mejor solución es: [0, 1, 4, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1936.

Generación 96.

La mejor solución es: [0, 1, 4, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1936.

Generación 97.

La mejor solución es: [0, 1, 4, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1936.

Generación 98.

La mejor solución es: [0, 1, 4, 18, 26, 5, 19, 13, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 10, 6, 14, 15, 7, 31, 17, 28, 2, 27, 29, 30, 32, 33, 34, 22, 24, 40, 41, 25, 11, 12, 3].

Con distancia 1935.

Generación 99.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1917.

Generación 100.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1917.

Generación 101.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1917.

Generación 102.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 32, 2, 27, 29, 30, 28, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].



Con distancia 1917.

Generación 103.

La mejor solución es: [3, 1, 0, 4, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 32, 2, 27, 29, 30, 28, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1910.

Generación 104.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 28, 2, 27, 29, 30, 32, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1905.

Generación 105.

La mejor solución es: [3, 1, 0, 4, 26, 5, 6, 15, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 18, 13, 19, 14, 7, 17, 31, 32, 2, 27, 28, 30, 29, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1903.

Generación 106.

La mejor solución es: [3, 1, 0, 4, 26, 5, 6, 15, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 18, 13, 19, 14, 7, 17, 31, 32, 2, 27, 28, 30, 29, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1903.

Generación 107.

La mejor solución es: [3, 1, 0, 4, 26, 5, 6, 15, 16, 37, 36, 35, 20, 38, 39, 21, 9, 23, 8, 18, 13, 19, 14, 7, 17, 31, 32, 2, 27, 28, 30, 29, 33, 34, 22, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1903.

Generación 108.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 28, 2, 27, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1895.

Generación 109.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 28, 2, 27, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1895.

Generación 110.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 28, 2, 27, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1895.

Generación 111.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 28, 2, 27, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1895.

Generación 112.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 28, 2, 27, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1895.

Generación 113.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 28, 2, 27, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1895.

Generación 114.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 28, 2, 27, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1888.

Generación 115.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 28, 2, 27, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1888.

Generación 116.

La mejor solución es: [3, 1, 0, 4, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1870.

Generación 117.

La mejor solución es: [3, 1, 0, 4, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1870.

Generación 118.

La mejor solución es: [3, 1, 0, 4, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1870.

Generación 119.

La mejor solución es: [3, 1, 0, 4, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1870.

Generación 120.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 15, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1866.

Generación 121.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 15, 16, 37, 36, 35, 20, 22, 39, 21, 9,

23, 8, 18, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1866.

Generación 122.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 15, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 18, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 10].

Con distancia 1866.

Generación 123.

La mejor solución es: [3, 1, 0, 4, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1852.

Generación 124.

La mejor solución es: [3, 1, 0, 4, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1852.

Generación 125.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1846.

Generación 126.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1846.

Generación 127.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 15, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1845.

Generación 128.

La mejor solución es: [4, 1, 0, 3, 26, 5, 6, 15, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1845.

Generación 129.

La mejor solución es: [4, 1, 0, 3, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1836.

Generación 130.

La mejor solución es: [4, 1, 0, 3, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1836.

Generación 131.

La mejor solución es: [4, 1, 0, 3, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1836.

Generación 132.

La mejor solución es: [4, 1, 0, 3, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1836.

Generación 133.

La mejor solución es: [4, 1, 0, 3, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1829.

Generación 134.

La mejor solución es: [4, 1, 0, 3, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1829.

Generación 135.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1813.

Generación 136.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1813.

Generación 137.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1813.

Generación 138.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1813.

Generación 139.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1813.

Generación 140.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 33, 34, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1813.

Generación 141.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1806.

Generación 142.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1806.

Generación 143.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1806.

Generación 144.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 2 3, 9, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2 5, 11, 12, 18].

Con distancia 1802.

Generación 145.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 2 3, 9, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2 5, 11, 12, 18].

Con distancia 1802.

Generación 146.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 16, 37, 36, 35, 20, 22, 39, 21, 2 3, 9, 8, 10, 13, 19, 15, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2 5, 11, 12, 18].

Con distancia 1802.

Generación 147.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 16, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1798.

Generación 148.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 16, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1798.

Generación 149.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 15, 37, 36, 35, 20, 22, 39, 21, 9,

23, 8, 10, 13, 19, 16, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1798.

Generación 150.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 16, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1798.

Generación 151.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 16, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1798.

Generación 152.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 14, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 16, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1798.

Generación 153.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 16, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1794.

Generación 154.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 16, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1794.

Generación 155.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 16, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1794.

Generación 156.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 16, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1794.

Generación 157.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 16, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1794.

Generación 158.

La mejor solución es: [4, 3, 0, 1, 6, 5, 26, 16, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1794.

Generación 159.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1781.

Generación 160.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1781.

Generación 161.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1781.

Generación 162.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1781.

Generación 163.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1781.

Generación 164.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 9, 23, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1781.

Generación 165.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2 5, 11, 12, 18].

Con distancia 1777.

Generación 166.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2 5, 11, 12, 18].

Con distancia 1777.

Generación 167.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2 5, 11, 12, 18].

Con distancia 1777.

Generación 168.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 169.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 170.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 171.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 172.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 173.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 174.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 175.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 176.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 177.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2



3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 178.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 179.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 180.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 181.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 182.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 183.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 184.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 185.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 186.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 187.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 188.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 189.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 190.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 191.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 192.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 193.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 194.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 195.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 196.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 197.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 198.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 199.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 200.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 201.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 202.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 203.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 204.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 205.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2

3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2  
5, 11, 12, 18].

Con distancia 1777.

Generación 206.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2  
3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2  
5, 11, 12, 18].

Con distancia 1777.

Generación 207.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2  
3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2  
5, 11, 12, 18].

Con distancia 1777.

Generación 208.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2  
3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2  
5, 11, 12, 18].

Con distancia 1777.

Generación 209.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2  
3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2  
5, 11, 12, 18].

Con distancia 1777.

Generación 210.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2  
3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2  
5, 11, 12, 18].

Con distancia 1777.

Generación 211.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2  
3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2  
5, 11, 12, 18].

Con distancia 1777.

Generación 212.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2  
3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2  
5, 11, 12, 18].

Con distancia 1777.

Generación 213.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2  
3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2  
5, 11, 12, 18].

Con distancia 1777.

Generación 214.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2  
3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2  
5, 11, 12, 18].

Con distancia 1777.

Generación 215.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 216.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 217.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 218.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 219.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 220.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 221.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 222.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 223.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 224.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 225.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 226.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 227.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 228.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 229.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 230.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 231.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 232.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 233.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2

3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 234.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 235.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 236.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 237.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 238.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 239.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 240.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 241.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 242.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 23, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 25, 11, 12, 18].

Con distancia 1777.

Generación 243.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 244.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 245.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 246.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 247.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 248.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 249.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 250.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.

Generación 251.

La mejor solución es: [4, 3, 0, 1, 6, 26, 5, 16, 15, 37, 36, 35, 20, 22, 39, 21, 2, 3, 9, 8, 10, 13, 19, 14, 7, 17, 31, 27, 2, 28, 29, 30, 32, 34, 33, 38, 24, 40, 41, 2, 5, 11, 12, 18].

Con distancia 1777.



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