MTH6412B - Projet Phase 1

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Question 1)

```
include("node.jl")
include("graph.jl")
include("read_stsp.jl")

plot_graph
```

Question 2)

Création du type `Edge` :

```
"""
Type abstrait dont d'autres types d'arêtes dériveront.
"""
abstract type AbstractEdge{T, U} end

"""
Type représentant les arêtes d'un graphe.

Exemple:

    node1 = Node("Joe", 3.14)
    node2 = Node("Steve", exp(1))
    edge = Edge(node1, node2)       # Arête non pondérée
    edge = Edge(node1, node2, 5.6)  # Arête pondérée avec un poids de
5.6
"""
mutable struct Edge{T, U} <: AbstractEdge{T, U}
  start_node::Node{T}                           # Le nœud de départ
de l'arête.
  end_node::Node{T}                             # Le nœud d'arrivée
de l'arête.
  weight::U                                     # Le poids de
l'arête. Ce champ peut être générique
end                                             #  et peut être
nothing s'il s'agit d'une arête non pondérée.

# Constructeur pour les arêtes non pondérées
Edge(s::Node{T}, e::Node{T}) where T = Edge(s, e, nothing)

# on présume que toutes les arêtes dérivant d'AbstractEdge
# posséderont des champs `start_node`, `end_node` et `weight`.

"""Renvoie le noeud de départ de l'arête."""
```

(Annotations manuscrites en rouge :)

20/20

adresse du dépôt

```
mutable My Struct{A}
  field :: Union{A, Nothing}
end

a = My Struct{Int}(nothing)
a.field = 1
```

weight::U :: Union{Nothing, U}

⚠ cela fixe U à :: Nothing

Edge{T,U}(s, e, nothing)

Votre choix par défaut

```julia
start_node(edge::AbstractEdge) = edge.start_node

"""Renvoie le noeud d'arrivée de l'arête."""
end_node(edge::AbstractEdge) = edge.end_node

"""Renvoie le poids de l'arête."""
weight(edge::AbstractEdge) = edge.weight

"""Affiche une arête."""
function show(edge::AbstractEdge)
    if edge.weight === nothing
        println("Edge from ", name(start_node(edge)), " to ",
name(end_node(edge)))
    else
        println("Edge from ", name(start_node(edge)), " to ",
name(end_node(edge)), ", weight: ", weight(edge))
    end
end

Base.show
```

Handwritten annotations (in red):

Si Union {U, Nothing}

show(edge::Edge(...

...::Nothing)

show(edge::Edge(...;

T)) where T

✓

Exemple d'utilisation du type `Edge`:

```julia
edge_test = Edge(Node("a", 1.0), Node("b", 2.4))

Edge{Float64, Nothing}(Node{Float64}("a", 1.0), Node{Float64}("b",
2.4), nothing)

show(edge_test)

Edge from a to b

using Test

@testset "Edge Tests" begin
    node1 = Node("A", 1.0)
    node2 = Node("B", 2.0)
    edge_unweighted = Edge(node1, node2)
    edge_weighted = Edge(node1, node2, 3.0)

    @test start_node(edge_unweighted) == node1
    @test end_node(edge_unweighted) == node2
    @test weight(edge_unweighted) == nothing

    @test start_node(edge_weighted) == node1
    @test end_node(edge_weighted) == node2
    @test weight(edge_weighted) == 3.0

end
```

Handwritten annotation (in red): ropes!

```
Test Summary: | Pass  Total  Time
Edge Tests    |    6      6  0.2s

Test.DefaultTestSet("Edge Tests", Any[], 6, false, false, true,
1.696896904163e9, 1.696896904362e9, false)
```

Question 3)

Extension du type `Graph` pour contenir les arêtes du graphe

```julia
# Définir un nouveau type `ExtendedGraph`
mutable struct ExtendedGraph{T} <: AbstractGraph{T}
  name::String
  nodes::Vector{Node{T}}
  edges::Vector{Edge{T}}
end

# Constructeur pour ExtendedGraph
ExtendedGraph(name::String, nodes::Vector{Node{T}}) where T =
ExtendedGraph(name, nodes, Edge{T}[])

# Fonction pour ajouter un noeud à un AbstractGraph :

"""Ajoute un noeud à un ExtendedGraph"""
# Arguments :
# - `graph::AbstractGraph{T}` : Le graphe auquel ajouter le noeud.
# - `node::Node{T}` : Le noeud à ajouter au graphe.

function add_node!(graph::AbstractGraph{T}, node::Node{T}) where T
  push!(graph.nodes, node)
  graph
end

# Fonction pour ajouter une arête à ExtendedGraph
"""Ajoute une arête à un ExtendedGraph"""
# graph::ExtendedGraph{T} : Le graphe auquel ajouter l'arête.
# start_node::Node{T} : Le nœud de départ de l'arête.
# end_node::Node{T} : Le nœud d'arrivée de l'arête.
# weight::T (optionnel) : Le poids de l'arête (par défaut nothing si
non spécifié).

function add_edge!(graph::ExtendedGraph{T}, start_node::Node{T},
end_node::Node{T}, weight = nothing) where {T}
  # Vérifier si les nœuds existent déjà dans le graphe
  if start_node ∉ graph.nodes || end_node ∉ graph.nodes
      throw(ArgumentError("One or both nodes are not part of the
graph"))
  end

  # Créer la nouvelle arête
```

Bonne idée de faire une nouvelle structure (note manuscrite)

Format de la doc (note manuscrite)

```julia
    new_edge = Edge(start_node, end_node, weight)

    # Vérifier si l'arête existe déjà
    for edge in graph.edges
        if (edge.start_node == start_node && edge.end_node == end_node) ||
           (edge.start_node == end_node && edge.end_node == start_node)
            return  # simplement retourner si l'arête existe déjà, évitant une erreur

        end
    end

    # Ajouter la nouvelle arête au graphe
    push!(graph.edges, new_edge)
end

add_edge! (generic function with 2 methods)

ext_graph = ExtendedGraph("graph_test", [Node("a", 1.0), Node("b", 2.4), Node("c", 3.0)])

ExtendedGraph{Float64}("graph_test", Node{Float64}[Node{Float64}("a", 1.0), Node{Float64}("b", 2.4), Node{Float64}("c", 3.0)], Edge{Float64}[])

add_edge!(ext_graph, ext_graph.nodes[1], ext_graph.nodes[2])

1-element Vector{Edge{Float64}}:
 Edge{Float64, Nothing}(Node{Float64}("a", 1.0), Node{Float64}("b", 2.4), nothing)

using Test

# Créer un graphe vide pour les tests
graph = ExtendedGraph("Graphe de test", Node{Float64}[])

# Test pour add_node!
@testset "Tests pour add_node!" begin
    # Vérifier que le graphe est initialement vide
    @test length(graph.nodes) == 0

    # Ajouter un nœud au graphe
    node = Node("Noeud 1", 3.14)
    add_node!(graph, node)

    # Vérifier que le nœud a été ajouté
    @test length(graph.nodes) == 1
    @test graph.nodes[1] === node
end
```

(Annotation manuscrite en rouge :) Vous pouvez aussi implémenter la fonction == entre 2 Edges et l'utiliser à nouveau

```
# Test pour add_edge!
@testset "Tests pour add_edge!" begin
    # Ajouter quelques nœuds au graphe
    node1 = Node("Noeud 1", 3.14)
    node2 = Node("Noeud 2", 2.71)
    add_node!(graph, node1)
    add_node!(graph, node2)

    # Ajouter une arête au graphe
    add_edge!(graph, node1, node2, 1.0)

    # Vérifier que l'arête a été ajoutée
    @test length(graph.edges) == 1
    edge = graph.edges[1]
    @test start_node(edge) === node1
    @test end_node(edge) === node2
    @test weight(edge) == 1.0
end
```

```
Test Summary:          | Pass  Total  Time
Tests pour add_node! |     3      3  0.0s
Test Summary:          | Pass  Total  Time
Tests pour add_edge! |     4      4

Test.DefaultTestSet("Tests pour add_edge!", Any[], 4, false, false,
true, 1.696896905841e9, 1.696896905862e9, false)

0.0s
```

Question 4)

Implémentation de `show` pour un objet de type `ExtendedGraph`

```
# Affichage de ExtendedGraph
"""Extension de la fonction `show`pour un ExtendedGraph"""
function show(graph::ExtendedGraph{T}) where {T}
  println("Graph ", name(graph), " has ", nb_nodes(graph), " nodes and
", length(graph.edges), " edges.")
  println("Nodes:")
  for node in nodes(graph)
      show(node)
  end
  println("Edges:")
  for edge in graph.edges
      show(edge)
  end
end

Base.show
```

```
show(ext_graph)

Graph graph_test has 3 nodes and 1 edges.
Nodes:
Node a, data: 1.0
Node b, data: 2.4
Node c, data: 3.0
Edges:
Edge from a to b
```

Question 5)

La méthode `read_edges()` affiche les arêtes des graphes, mais ignore leurs poids.

```
header = read_header("instances/stsp/bayg29.tsp")
read_edges(header, "instances/stsp/bayg29.tsp")

406-element Vector{Any}:
 (1, 2)
 (1, 3)
 (1, 4)
 (1, 5)
 (1, 6)
 (1, 7)
 (1, 8)
 (1, 9)
 (1, 10)
 (1, 11)
 ⋮
 (25, 27)
 (25, 28)
 (25, 29)
 (26, 27)
 (26, 28)
 (26, 29)
 (27, 28)
 (27, 29)
 (28, 29)
```

Modification de la méthode `read_edges()` :

```
"""Analyse un fichier .tsp et renvoie l'ensemble des arêtes sous la
forme d'un tableau."""
#  Arguments
# - `header::Dict{String, String}` : Le dictionnaire contenant les
informations de l'en-tête du fichier .tsp.
# - `filename::String` : Le nom du fichier .tsp à analyser.

#  Résultats
```

```julia
# - `edges::Vector{Tuple{Int, Int, Float64}}` : Un tableau d'arêtes
représentées sous forme de tuples (nœud de départ, nœud d'arrivée,
poids).
function read_edges(header::Dict{String, String}, filename::String)

    edges = []
    edge_weight_format = header["EDGE_WEIGHT_FORMAT"]
    known_edge_weight_formats = ["FULL_MATRIX", "UPPER_ROW",
"LOWER_ROW",
    "UPPER_DIAG_ROW", "LOWER_DIAG_ROW", "UPPER_COL", "LOWER_COL",
    "UPPER_DIAG_COL", "LOWER_DIAG_COL"]

    if !(edge_weight_format in known_edge_weight_formats)
        @warn "unknown edge weight format" edge_weight_format
        return edges, edge_weights
    end

    file = open(filename, "r")
    dim = parse(Int, header["DIMENSION"])
    edge_weight_section = false
    k = 0
    n_edges = 0
    i = 0
    n_to_read = n_nodes_to_read(edge_weight_format, k, dim)
    flag = false

    for line in eachline(file)
        line = strip(line)
        if !flag
            if occursin(r"^EDGE_WEIGHT_SECTION", line)
                edge_weight_section = true
                continue
            end

            if edge_weight_section
                data = split(line)
                n_data = length(data)
                start = 0
                while n_data > 0
                    n_on_this_line = min(n_to_read, n_data)

                    for j = start : start + n_on_this_line - 1
                        # Les lignes suivantes ont été modifiées pour
tenir compte du poids des arêtes
                        n_edges = n_edges + 1
                        edge_weight_value = parse(Float64,
data[start+j+1])

                        if edge_weight_format in ["UPPER_ROW",
"LOWER_COL"]
```

```julia
                            edge = (k+1, i+k+2, edge_weight_value)
                        elseif edge_weight_format in ["UPPER_DIAG_ROW",
"LOWER_DIAG_COL"]
                            edge = (k+1, i+k+1, edge_weight_value)
                        elseif edge_weight_format in ["UPPER_COL",
"LOWER_ROW"]
                            edge = (i+k+2, k+1, edge_weight_value)
                        elseif edge_weight_format in ["UPPER_DIAG_COL",
"LOWER_DIAG_ROW"]
                            edge = (i+1, k+1, edge_weight_value)
                        elseif edge_weight_format == "FULL_MATRIX"
                            edge = (k+1, i+1, edge_weight_value)
                        else
                            warn("Unknown format - function read_edges")
                        end
                        push!(edges, edge)
                        i += 1
                    end

                    n_to_read -= n_on_this_line
                    n_data -= n_on_this_line

                    if n_to_read <= 0
                        start += n_on_this_line
                        k += 1
                        i = 0
                        n_to_read = n_nodes_to_read(edge_weight_format,
k, dim)
                    end

                    if k >= dim
                        n_data = 0
                        flag = true
                    end
                end
            end
        end
    end
    close(file)
    return edges
end
```

read_edges (generic function with 1 method)

```julia
r = read_edges(header, "instances/stsp/bayg29.tsp")
```

```
406-element Vector{Any}:
 (1, 2, 97.0)
 (1, 3, 205.0)
 (1, 4, 139.0)
```

```
(1, 5, 86.0)
(1, 6, 60.0)
(1, 7, 220.0)
(1, 8, 65.0)
(1, 9, 111.0)
(1, 10, 115.0)
(1, 11, 227.0)
⋮
(25, 27, 120.0)
(25, 28, 205.0)
(25, 29, 270.0)
(26, 27, 213.0)
(26, 28, 145.0)
(26, 29, 36.0)
(27, 28, 94.0)
(27, 29, 217.0)
(28, 29, 162.0)
```

Question 6)

L'instance `bays29.tsp` est une matrice pleine symétrique dont les poids sont donnés au format `EXPLICIT`

```
header = read_header("instances/stsp/bays29.tsp")
nodes_graph = read_nodes(header, "instances/stsp/bays29.tsp")
edges_graph = read_edges(header, "instances/stsp/bays29.tsp")

841-element Vector{Any}:
 (1, 1, 0.0)
 (1, 2, 107.0)
 (1, 3, 241.0)
 (1, 4, 190.0)
 (1, 5, 124.0)
 (1, 6, 80.0)
 (1, 7, 316.0)
 (1, 8, 76.0)
 (1, 9, 152.0)
 (1, 10, 157.0)
 ⋮
 (29, 21, 108.0)
 (29, 22, 332.0)
 (29, 23, 342.0)
 (29, 24, 218.0)
 (29, 25, 350.0)
 (29, 26, 39.0)
 (29, 27, 263.0)
 (29, 28, 199.0)
 (29, 29, 0.0)
```

Nous avons créé un vecteur contenant les arêtes et les poids des arêtes. Construisons à présent l'objet `Graph` correspondant :

```julia
"""Construit un graphe à partir d'une instance TSP symétrique dont les
poids sont donnés au format EXPLICIT et renvoie l'objet Graph
associé"""
#  Arguments
# - `instance::String` : Le chemin vers le fichier TSP contenant les
données de l'instance.
# - `title::String` : Le titre du graphe construit.
# Examples
```
julia> build_graph("instances/stsp/bays29.tsp", "Graph_Test")

Graph Graph_Test has 29 nodes and 435 edges.
Nodes:
Node 1, data: [1150.0, 1760.0]
Node 2, data: [630.0, 1660.0]
... (d'autres nœuds et arêtes)
Edge from 28 to 29, weight: 199.0
Edge from 29 to 29, weight: 0.0
```

function build_graph(instance::String, title::String)

  header = read_header(instance)
  if header["EDGE_WEIGHT_TYPE"] != "EXPLICIT"
    @warn "weight type format must be `EXPLICIT`"
    return "Current format is :", header["EDGE_WEIGHT_TYPE"]
  end
  if header["EDGE_WEIGHT_FORMAT"] != "FULL_MATRIX"
    @warn "edge weight format must be `FULL_MATRIX`"
    return "Current format is :", header["EDGE_WEIGHT_FORMAT"]
  end

  nodes_graph = read_nodes(header, instance)
  edges_graph = read_edges(header, instance)

  if isempty(nodes_graph)
    for i = 1:parse(Int64, header["DIMENSION"])
      dict_intermediaire = Dict(i => [])
      merge!(nodes_graph, dict_intermediaire)
    end
  end


  graph_built = ExtendedGraph(title, [Node("1", nodes_graph[1])])
  for i=2:length(nodes_graph)
    node = Node(string(i), nodes_graph[i])
    add_node!(graph_built, node)
```

```
        end

    for i=1:length(edges_graph)
        s_node = graph_built.nodes[edges_graph[i][1]]
        e_node = graph_built.nodes[edges_graph[i][2]]
        w_edge = edges_graph[i][3]
        add_edge!(graph_built, s_node, e_node, w_edge)
    end
    show(graph_built)
end

build_graph
```

On test le `graph_built()` avec le fichier bays29.tsp car il s'agit d'une instance de TSP symétrique dont les poids sont donnés au format EXPLICIT.

Il est important de noter que nous n'avons considéré que les matrices comme étant symétriques de plein rang (FULL_MATRIX). Il aurait été possible de prendre en compte les matrices triangulaires supérieures (UPPER_ROW) et inférieures (LOWER_ROW) si l'énoncé avait spécifié qu'il s'agissait de matrices symétriques.

```
build_graph("/instances/stsp/bays29.tsp", "Graph_Test")

Graph Graph_Test has 29 nodes and 435 edges.
Nodes:
Node 1, data: [1150.0, 1760.0]
Node 2, data: [630.0, 1660.0]
Node 3, data: [40.0, 2090.0]
Node 4, data: [750.0, 1100.0]
Node 5, data: [750.0, 2030.0]
Node 6, data: [1030.0, 2070.0]
Node 7, data: [1650.0, 650.0]
Node 8, data: [1490.0, 1630.0]
Node 9, data: [790.0, 2260.0]
Node 10, data: [710.0, 1310.0]
Node 11, data: [840.0, 550.0]
Node 12, data: [1170.0, 2300.0]
Node 13, data: [970.0, 1340.0]
Node 14, data: [510.0, 700.0]
Node 15, data: [750.0, 900.0]
Node 16, data: [1280.0, 1200.0]
Node 17, data: [230.0, 590.0]
Node 18, data: [460.0, 860.0]
Node 19, data: [1040.0, 950.0]
Node 20, data: [590.0, 1390.0]
Node 21, data: [830.0, 1770.0]
Node 22, data: [490.0, 500.0]
Node 23, data: [1840.0, 1240.0]
Node 24, data: [1260.0, 1500.0]
Node 25, data: [1280.0, 790.0]
```

```
Node 26, data: [490.0, 2130.0]
Node 27, data: [1460.0, 1420.0]
Node 28, data: [1260.0, 1910.0]
Node 29, data: [360.0, 1980.0]
Edges:
Edge from 1 to 1, weight: 0.0
Edge from 1 to 2, weight: 107.0
Edge from 1 to 3, weight: 241.0
Edge from 1 to 4, weight: 190.0
Edge from 1 to 5, weight: 124.0
Edge from 1 to 6, weight: 80.0
Edge from 1 to 7, weight: 316.0
Edge from 1 to 8, weight: 76.0
Edge from 1 to 9, weight: 152.0
Edge from 1 to 10, weight: 157.0
Edge from 1 to 11, weight: 283.0
Edge from 1 to 12, weight: 133.0
Edge from 1 to 13, weight: 113.0
Edge from 1 to 14, weight: 297.0
Edge from 1 to 15, weight: 228.0
Edge from 1 to 16, weight: 129.0
Edge from 1 to 17, weight: 348.0
Edge from 1 to 18, weight: 276.0
Edge from 1 to 19, weight: 188.0
Edge from 1 to 20, weight: 150.0
Edge from 1 to 21, weight: 65.0
Edge from 1 to 22, weight: 341.0
Edge from 1 to 23, weight: 184.0
Edge from 1 to 24, weight: 67.0
Edge from 1 to 25, weight: 221.0
Edge from 1 to 26, weight: 169.0
Edge from 1 to 27, weight: 108.0
Edge from 1 to 28, weight: 45.0
Edge from 1 to 29, weight: 167.0
Edge from 2 to 2, weight: 0.0
Edge from 2 to 3, weight: 148.0
Edge from 2 to 4, weight: 137.0
Edge from 2 to 5, weight: 88.0
Edge from 2 to 6, weight: 127.0
Edge from 2 to 7, weight: 336.0
Edge from 2 to 8, weight: 183.0
Edge from 2 to 9, weight: 134.0
Edge from 2 to 10, weight: 95.0
Edge from 2 to 11, weight: 254.0
Edge from 2 to 12, weight: 180.0
Edge from 2 to 13, weight: 101.0
Edge from 2 to 14, weight: 234.0
Edge from 2 to 15, weight: 175.0
Edge from 2 to 16, weight: 176.0
```

```
Edge from 2 to 17, weight: 265.0
Edge from 2 to 18, weight: 199.0
Edge from 2 to 19, weight: 182.0
Edge from 2 to 20, weight: 67.0
Edge from 2 to 21, weight: 42.0
Edge from 2 to 22, weight: 278.0
Edge from 2 to 23, weight: 271.0
Edge from 2 to 24, weight: 146.0
Edge from 2 to 25, weight: 251.0
Edge from 2 to 26, weight: 105.0
Edge from 2 to 27, weight: 191.0
Edge from 2 to 28, weight: 139.0
Edge from 2 to 29, weight: 79.0
Edge from 3 to 3, weight: 0.0
Edge from 3 to 4, weight: 374.0
Edge from 3 to 5, weight: 171.0
Edge from 3 to 6, weight: 259.0
Edge from 3 to 7, weight: 509.0
Edge from 3 to 8, weight: 317.0
Edge from 3 to 9, weight: 217.0
Edge from 3 to 10, weight: 232.0
Edge from 3 to 11, weight: 491.0
Edge from 3 to 12, weight: 312.0
Edge from 3 to 13, weight: 280.0
Edge from 3 to 14, weight: 391.0
Edge from 3 to 15, weight: 412.0
Edge from 3 to 16, weight: 349.0
Edge from 3 to 17, weight: 422.0
Edge from 3 to 18, weight: 356.0
Edge from 3 to 19, weight: 355.0
Edge from 3 to 20, weight: 204.0
Edge from 3 to 21, weight: 182.0
Edge from 3 to 22, weight: 435.0
Edge from 3 to 23, weight: 417.0
Edge from 3 to 24, weight: 292.0
Edge from 3 to 25, weight: 424.0
Edge from 3 to 26, weight: 116.0
Edge from 3 to 27, weight: 337.0
Edge from 3 to 28, weight: 273.0
Edge from 3 to 29, weight: 77.0
Edge from 4 to 4, weight: 0.0
Edge from 4 to 5, weight: 202.0
Edge from 4 to 6, weight: 234.0
Edge from 4 to 7, weight: 222.0
Edge from 4 to 8, weight: 192.0
Edge from 4 to 9, weight: 248.0
Edge from 4 to 10, weight: 42.0
Edge from 4 to 11, weight: 117.0
Edge from 4 to 12, weight: 287.0
```

```
Edge from 4 to 13, weight: 79.0
Edge from 4 to 14, weight: 107.0
Edge from 4 to 15, weight: 38.0
Edge from 4 to 16, weight: 121.0
Edge from 4 to 17, weight: 152.0
Edge from 4 to 18, weight: 86.0
Edge from 4 to 19, weight: 68.0
Edge from 4 to 20, weight: 70.0
Edge from 4 to 21, weight: 137.0
Edge from 4 to 22, weight: 151.0
Edge from 4 to 23, weight: 239.0
Edge from 4 to 24, weight: 135.0
Edge from 4 to 25, weight: 137.0
Edge from 4 to 26, weight: 242.0
Edge from 4 to 27, weight: 165.0
Edge from 4 to 28, weight: 228.0
Edge from 4 to 29, weight: 205.0
Edge from 5 to 5, weight: 0.0
Edge from 5 to 6, weight: 61.0
Edge from 5 to 7, weight: 392.0
Edge from 5 to 8, weight: 202.0
Edge from 5 to 9, weight: 46.0
Edge from 5 to 10, weight: 160.0
Edge from 5 to 11, weight: 319.0
Edge from 5 to 12, weight: 112.0
Edge from 5 to 13, weight: 163.0
Edge from 5 to 14, weight: 322.0
Edge from 5 to 15, weight: 240.0
Edge from 5 to 16, weight: 232.0
Edge from 5 to 17, weight: 314.0
Edge from 5 to 18, weight: 287.0
Edge from 5 to 19, weight: 238.0
Edge from 5 to 20, weight: 155.0
Edge from 5 to 21, weight: 65.0
Edge from 5 to 22, weight: 366.0
Edge from 5 to 23, weight: 300.0
Edge from 5 to 24, weight: 175.0
Edge from 5 to 25, weight: 307.0
Edge from 5 to 26, weight: 57.0
Edge from 5 to 27, weight: 220.0
Edge from 5 to 28, weight: 121.0
Edge from 5 to 29, weight: 97.0
Edge from 6 to 6, weight: 0.0
Edge from 6 to 7, weight: 386.0
Edge from 6 to 8, weight: 141.0
Edge from 6 to 9, weight: 72.0
Edge from 6 to 10, weight: 167.0
Edge from 6 to 11, weight: 351.0
Edge from 6 to 12, weight: 55.0
```

```
Edge from 6 to 13, weight: 157.0
Edge from 6 to 14, weight: 331.0
Edge from 6 to 15, weight: 272.0
Edge from 6 to 16, weight: 226.0
Edge from 6 to 17, weight: 362.0
Edge from 6 to 18, weight: 296.0
Edge from 6 to 19, weight: 232.0
Edge from 6 to 20, weight: 164.0
Edge from 6 to 21, weight: 85.0
Edge from 6 to 22, weight: 375.0
Edge from 6 to 23, weight: 249.0
Edge from 6 to 24, weight: 147.0
Edge from 6 to 25, weight: 301.0
Edge from 6 to 26, weight: 118.0
Edge from 6 to 27, weight: 188.0
Edge from 6 to 28, weight: 60.0
Edge from 6 to 29, weight: 185.0
Edge from 7 to 7, weight: 0.0
Edge from 7 to 8, weight: 233.0
Edge from 7 to 9, weight: 438.0
Edge from 7 to 10, weight: 254.0
Edge from 7 to 11, weight: 202.0
Edge from 7 to 12, weight: 439.0
Edge from 7 to 13, weight: 235.0
Edge from 7 to 14, weight: 254.0
Edge from 7 to 15, weight: 210.0
Edge from 7 to 16, weight: 187.0
Edge from 7 to 17, weight: 313.0
Edge from 7 to 18, weight: 266.0
Edge from 7 to 19, weight: 154.0
Edge from 7 to 20, weight: 282.0
Edge from 7 to 21, weight: 321.0
Edge from 7 to 22, weight: 298.0
Edge from 7 to 23, weight: 168.0
Edge from 7 to 24, weight: 249.0
Edge from 7 to 25, weight: 95.0
Edge from 7 to 26, weight: 437.0
Edge from 7 to 27, weight: 190.0
Edge from 7 to 28, weight: 314.0
Edge from 7 to 29, weight: 435.0
Edge from 8 to 8, weight: 0.0
Edge from 8 to 9, weight: 213.0
Edge from 8 to 10, weight: 188.0
Edge from 8 to 11, weight: 272.0
Edge from 8 to 12, weight: 193.0
Edge from 8 to 13, weight: 131.0
Edge from 8 to 14, weight: 302.0
Edge from 8 to 15, weight: 233.0
Edge from 8 to 16, weight: 98.0
```

```
Edge from 8 to 17, weight: 344.0
Edge from 8 to 18, weight: 289.0
Edge from 8 to 19, weight: 177.0
Edge from 8 to 20, weight: 216.0
Edge from 8 to 21, weight: 141.0
Edge from 8 to 22, weight: 346.0
Edge from 8 to 23, weight: 108.0
Edge from 8 to 24, weight: 57.0
Edge from 8 to 25, weight: 190.0
Edge from 8 to 26, weight: 245.0
Edge from 8 to 27, weight: 43.0
Edge from 8 to 28, weight: 81.0
Edge from 8 to 29, weight: 243.0
Edge from 9 to 9, weight: 0.0
Edge from 9 to 10, weight: 206.0
Edge from 9 to 11, weight: 365.0
Edge from 9 to 12, weight: 89.0
Edge from 9 to 13, weight: 209.0
Edge from 9 to 14, weight: 368.0
Edge from 9 to 15, weight: 286.0
Edge from 9 to 16, weight: 278.0
Edge from 9 to 17, weight: 360.0
Edge from 9 to 18, weight: 333.0
Edge from 9 to 19, weight: 284.0
Edge from 9 to 20, weight: 201.0
Edge from 9 to 21, weight: 111.0
Edge from 9 to 22, weight: 412.0
Edge from 9 to 23, weight: 321.0
Edge from 9 to 24, weight: 221.0
Edge from 9 to 25, weight: 353.0
Edge from 9 to 26, weight: 72.0
Edge from 9 to 27, weight: 266.0
Edge from 9 to 28, weight: 132.0
Edge from 9 to 29, weight: 111.0
Edge from 10 to 10, weight: 0.0
Edge from 10 to 11, weight: 159.0
Edge from 10 to 12, weight: 220.0
Edge from 10 to 13, weight: 57.0
Edge from 10 to 14, weight: 149.0
Edge from 10 to 15, weight: 80.0
Edge from 10 to 16, weight: 132.0
Edge from 10 to 17, weight: 193.0
Edge from 10 to 18, weight: 127.0
Edge from 10 to 19, weight: 100.0
Edge from 10 to 20, weight: 28.0
Edge from 10 to 21, weight: 95.0
Edge from 10 to 22, weight: 193.0
Edge from 10 to 23, weight: 241.0
Edge from 10 to 24, weight: 131.0
```

```
Edge from 10 to 25, weight: 169.0
Edge from 10 to 26, weight: 200.0
Edge from 10 to 27, weight: 161.0
Edge from 10 to 28, weight: 189.0
Edge from 10 to 29, weight: 163.0
Edge from 11 to 11, weight: 0.0
Edge from 11 to 12, weight: 404.0
Edge from 11 to 13, weight: 176.0
Edge from 11 to 14, weight: 106.0
Edge from 11 to 15, weight: 79.0
Edge from 11 to 16, weight: 161.0
Edge from 11 to 17, weight: 165.0
Edge from 11 to 18, weight: 141.0
Edge from 11 to 19, weight: 95.0
Edge from 11 to 20, weight: 187.0
Edge from 11 to 21, weight: 254.0
Edge from 11 to 22, weight: 103.0
Edge from 11 to 23, weight: 279.0
Edge from 11 to 24, weight: 215.0
Edge from 11 to 25, weight: 117.0
Edge from 11 to 26, weight: 359.0
Edge from 11 to 27, weight: 216.0
Edge from 11 to 28, weight: 308.0
Edge from 11 to 29, weight: 322.0
Edge from 12 to 12, weight: 0.0
Edge from 12 to 13, weight: 210.0
Edge from 12 to 14, weight: 384.0
Edge from 12 to 15, weight: 325.0
Edge from 12 to 16, weight: 279.0
Edge from 12 to 17, weight: 415.0
Edge from 12 to 18, weight: 349.0
Edge from 12 to 19, weight: 285.0
Edge from 12 to 20, weight: 217.0
Edge from 12 to 21, weight: 138.0
Edge from 12 to 22, weight: 428.0
Edge from 12 to 23, weight: 310.0
Edge from 12 to 24, weight: 200.0
Edge from 12 to 25, weight: 354.0
Edge from 12 to 26, weight: 169.0
Edge from 12 to 27, weight: 241.0
Edge from 12 to 28, weight: 112.0
Edge from 12 to 29, weight: 238.0
Edge from 13 to 13, weight: 0.0
Edge from

13 to 14, weight: 186.0
Edge from 13 to 15, weight: 117.0
Edge from 13 to 16, weight: 75.0
Edge from 13 to 17, weight: 231.0
Edge from 13 to 18, weight: 165.0
```

```
Edge from 13 to 19, weight: 81.0
Edge from 13 to 20, weight: 85.0
Edge from 13 to 21, weight: 92.0
Edge from 13 to 22, weight: 230.0
Edge from 13 to 23, weight: 184.0
Edge from 13 to 24, weight: 74.0
Edge from 13 to 25, weight: 150.0
Edge from 13 to 26, weight: 208.0
Edge from 13 to 27, weight: 104.0
Edge from 13 to 28, weight: 158.0
Edge from 13 to 29, weight: 206.0
Edge from 14 to 14, weight: 0.0
Edge from 14 to 15, weight: 69.0
Edge from 14 to 16, weight: 191.0
Edge from 14 to 17, weight: 59.0
Edge from 14 to 18, weight: 35.0
Edge from 14 to 19, weight: 125.0
Edge from 14 to 20, weight: 167.0
Edge from 14 to 21, weight: 255.0
Edge from 14 to 22, weight: 44.0
Edge from 14 to 23, weight: 309.0
Edge from 14 to 24, weight: 245.0
Edge from 14 to 25, weight: 169.0
Edge from 14 to 26, weight: 327.0
Edge from 14 to 27, weight: 246.0
Edge from 14 to 28, weight: 335.0
Edge from 14 to 29, weight: 288.0
Edge from 15 to 15, weight: 0.0
Edge from 15 to 16, weight: 122.0
Edge from 15 to 17, weight: 122.0
Edge from 15 to 18, weight: 56.0
Edge from 15 to 19, weight: 56.0
Edge from 15 to 20, weight: 108.0
Edge from 15 to 21, weight: 175.0
Edge from 15 to 22, weight: 113.0
Edge from 15 to 23, weight: 240.0
Edge from 15 to 24, weight: 176.0
Edge from 15 to 25, weight: 125.0
Edge from 15 to 26, weight: 280.0
Edge from 15 to 27, weight: 177.0
Edge from 15 to 28, weight: 266.0
Edge from 15 to 29, weight: 243.0
Edge from 16 to 16, weight: 0.0
Edge from 16 to 17, weight: 244.0
Edge from 16 to 18, weight: 178.0
Edge from 16 to 19, weight: 66.0
Edge from 16 to 20, weight: 160.0
Edge from 16 to 21, weight: 161.0
Edge from 16 to 22, weight: 235.0
```

```
Edge from 16 to 23, weight: 118.0
Edge from 16 to 24, weight: 62.0
Edge from 16 to 25, weight: 92.0
Edge from 16 to 26, weight: 277.0
Edge from 16 to 27, weight: 55.0
Edge from 16 to 28, weight: 155.0
Edge from 16 to 29, weight: 275.0
Edge from 17 to 17, weight: 0.0
Edge from 17 to 18, weight: 66.0
Edge from 17 to 19, weight: 178.0
Edge from 17 to 20, weight: 198.0
Edge from 17 to 21, weight: 286.0
Edge from 17 to 22, weight: 77.0
Edge from 17 to 23, weight: 362.0
Edge from 17 to 24, weight: 287.0
Edge from 17 to 25, weight: 228.0
Edge from 17 to 26, weight: 358.0
Edge from 17 to 27, weight: 299.0
Edge from 17 to 28, weight: 380.0
Edge from 17 to 29, weight: 319.0
Edge from 18 to 18, weight: 0.0
Edge from 18 to 19, weight: 112.0
Edge from 18 to 20, weight: 132.0
Edge from 18 to 21, weight: 220.0
Edge from 18 to 22, weight: 79.0
Edge from 18 to 23, weight: 296.0
Edge from 18 to 24, weight: 232.0
Edge from 18 to 25, weight: 181.0
Edge from 18 to 26, weight: 292.0
Edge from 18 to 27, weight: 233.0
Edge from 18 to 28, weight: 314.0
Edge from 18 to 29, weight: 253.0
Edge from 19 to 19, weight: 0.0
Edge from 19 to 20, weight: 128.0
Edge from 19 to 21, weight: 167.0
Edge from 19 to 22, weight: 169.0
Edge from 19 to 23, weight: 179.0
Edge from 19 to 24, weight: 120.0
Edge from 19 to 25, weight: 69.0
Edge from 19 to 26, weight: 283.0
Edge from 19 to 27, weight: 121.0
Edge from 19 to 28, weight: 213.0
Edge from 19 to 29, weight: 281.0
Edge from 20 to 20, weight: 0.0
Edge from 20 to 21, weight: 88.0
Edge from 20 to 22, weight: 211.0
Edge from 20 to 23, weight: 269.0
Edge from 20 to 24, weight: 159.0
Edge from 20 to 25, weight: 197.0
```

```
Edge from 20 to 26, weight: 172.0
Edge from 20 to 27, weight: 189.0
Edge from 20 to 28, weight: 182.0
Edge from 20 to 29, weight: 135.0
Edge from 21 to 21, weight: 0.0
Edge from 21 to 22, weight: 299.0
Edge from 21 to 23, weight: 229.0
Edge from 21 to 24, weight: 104.0

Edge from 21 to 25, weight: 236.0
Edge from 21 to 26, weight: 110.0
Edge from 21 to 27, weight: 149.0
Edge from 21 to 28, weight: 97.0
Edge from 21 to 29, weight: 108.0
Edge from 22 to 22, weight: 0.0
Edge from 22 to 23, weight: 353.0
Edge from 22 to 24, weight: 289.0
Edge from 22 to 25, weight: 213.0
Edge from 22 to 26, weight: 371.0
Edge from 22 to 27, weight: 290.0
Edge from 22 to 28, weight: 379.0
Edge from 22 to 29, weight: 332.0
Edge from 23 to 23, weight: 0.0
Edge from 23 to 24, weight: 121.0
Edge from 23 to 25, weight: 162.0
Edge from 23 to 26, weight: 345.0
Edge from 23 to 27, weight: 80.0
Edge from 23 to 28, weight: 189.0
Edge from 23 to 29, weight: 342.0
Edge from 24 to 24, weight: 0.0
Edge from 24 to 25, weight: 154.0
Edge from 24 to 26, weight: 220.0
Edge from 24 to 27, weight: 41.0
Edge from 24 to 28, weight: 93.0
Edge from 24 to 29, weight: 218.0
Edge from 25 to 25, weight: 0.0
Edge from 25 to 26, weight: 352.0
Edge from 25 to 27, weight: 147.0
Edge from 25 to 28, weight: 247.0
Edge from 25 to 29, weight: 350.0
Edge from 26 to 26, weight: 0.0
Edge from 26 to 27, weight: 265.0
Edge from 26 to 28, weight: 178.0
Edge from 26 to 29, weight: 39.0
Edge from 27 to 27, weight: 0.0
Edge from 27 to 28, weight: 124.0
Edge from 27 to 29, weight: 263.0
Edge from 28 to 28, weight: 0.0
Edge from 28 to 29, weight: 199.0
Edge from 29 to 29, weight: 0.0
```

Si le fichier satisfait les conditions de type et format, mais qu'il ne possède pas de valeurs associées au noeud, on construit un graphe composé de noeuds vides

```
build_graph("/instances/stsp/swiss42.tsp", "Graph_Test")

Graph Graph_Test has 42 nodes and 903 edges.
Nodes:
Node 1, data: Float64[]
Node 2, data: Float64[]
Node 3, data: Float64[]
Node 4, data: Float64[]
Node 5, data: Float64[]
Node 6, data: Float64[]
Node 7, data: Float64[]
Node 8, data: Float64[]
Node 9, data: Float64[]
Node 10, data: Float64[]
Node 11, data: Float64[]
Node 12, data: Float64[]
Node 13, data: Float64[]
Node 14, data: Float64[]
Node 15, data: Float64[]
Node 16, data: Float64[]
Node 17, data: Float64[]
Node 18, data: Float64[]
Node 19, data: Float64[]
Node 20, data: Float64[]
Node 21, data: Float64[]
Node 22, data: Float64[]
Node 23, data: Float64[]
Node 24, data: Float64[]
Node 25, data: Float64[]
Node 26, data: Float64[]
Node 27, data: Float64[]
Node 28, data: Float64[]
Node 29, data: Float64[]
Node 30, data: Float64[]
Node 31, data: Float64[]
Node 32, data: Float64[]
Node 33, data: Float64[]
Node 34, data: Float64[]
Node 35, data: Float64[]
Node 36, data: Float64[]
Node 37, data: Float64[]
Node 38, data: Float64[]
Node 39, data: Float64[]
Node 40, data: Float64[]
Node 41, data: Float64[]
Node 42, data: Float64[]
Edges:
```

```
Edge from 1 to 1, weight: 0.0
Edge from 1 to 2, weight: 15.0
Edge from 1 to 3, weight: 30.0
Edge from 1 to 4, weight: 23.0
Edge from 1 to 5, weight: 32.0
Edge from 1 to 6, weight: 55.0
Edge from 1 to 7, weight: 33.0
Edge from 1 to 8, weight: 37.0
Edge from 1 to 9, weight: 92.0
Edge from 1 to 10, weight: 114.0
Edge from 1 to 11, weight: 92.0
Edge from 1 to 12, weight: 110.0
Edge from 1 to 13, weight: 96.0
Edge from 1 to 14, weight: 90.0
Edge from 1 to 15, weight: 74.0
Edge from 1 to 16, weight: 76.0
Edge from 1 to 17, weight: 82.0
Edge from 1 to 18, weight: 67.0
Edge from 1 to 19, weight: 72.0
Edge from 1 to 20, weight: 78.0
Edge from 1 to 21, weight: 82.0
Edge from 1 to 22, weight: 159.0
Edge from 1 to 23, weight: 122.0
Edge from 1 to 24, weight: 131.0
Edge from 1 to 25, weight: 206.0
Edge from 1 to 26, weight: 112.0
Edge from 1 to 27, weight: 57.0
Edge from 1 to 28, weight: 28.0
Edge from 1 to 29, weight: 43.0
Edge from 1 to 30, weight: 70.0
Edge from 1 to 31, weight: 65.0
Edge from 1 to 32, weight: 66.0
Edge from 1 to 33, weight: 37.0
Edge from 1 to 34, weight: 103.0
Edge from 1 to 35, weight: 84.0
Edge from 1 to 36, weight: 125.0
Edge from 1 to 37, weight: 129.0
Edge from 1 to 38, weight: 72.0
Edge from 1 to 39, weight: 126.0
Edge from 1 to 40, weight: 141.0
Edge from 1 to 41, weight: 183.0
Edge from 1 to 42, weight: 124.0
Edge from 2 to 2, weight: 0.0
Edge from 2 to 3, weight: 34.0
Edge from 2 to 4, weight: 23.0
Edge from 2 to 5, weight: 27.0
Edge from 2 to 6, weight: 40.0
Edge from 2 to 7, weight: 19.0
Edge from 2 to 8, weight: 32.0
```

```
Edge from 2 to 9, weight: 93.0
Edge from 2 to 10, weight: 117.0
Edge from 2 to 11, weight: 88.0
Edge from 2 to 12, weight: 100.0
Edge from 2 to 13, weight: 87.0
Edge from 2 to 14, weight: 75.0
Edge from 2 to 15, weight: 63.0
Edge from 2 to 16, weight: 67.0
Edge from 2 to 17, weight: 71.0
Edge from 2 to 18, weight: 69.0
Edge from 2 to 19, weight: 62.0
Edge from 2 to 20, weight: 63.0
Edge from 2 to 21, weight: 96.0
Edge from 2 to 22, weight: 164.0
Edge from 2 to 23, weight: 132.0
Edge from 2 to 24, weight: 131.0
Edge from 2 to 25, weight: 212.0
Edge from 2 to 26, weight: 106.0
Edge from 2 to 27, weight: 44.0
Edge from 2 to 28, weight: 33.0
Edge from 2 to 29, weight: 51.0
Edge from 2 to 30, weight: 77.0
Edge from 2 to 31, weight: 75.0
Edge from 2 to 32, weight: 72.0
Edge from 2 to 33, weight: 52.0
Edge from 2 to 34, weight: 118.0
Edge from 2 to 35, weight: 99.0
Edge from 2 to 36, weight: 132.0
Edge from 2 to 37, weight: 132.0
Edge from 2 to 38, weight: 67.0
Edge from 2 to 39, weight: 139.0
Edge from 2 to 40, weight: 148.0
Edge from 2 to 41, weight: 186.0
Edge from 2 to 42, weight: 122.0
Edge from 3 to 3, weight: 0.0
Edge from 3 to 4, weight: 11.0
Edge from 3 to 5, weight: 18.0
Edge from 3 to 6, weight: 57.0
Edge from 3 to 7, weight: 36.0
Edge from 3 to 8, weight: 65.0
Edge from 3 to 9, weight: 62.0
Edge from 3 to 10, weight: 84.0
Edge from 3 to 11, weight: 64.0
Edge from 3 to 12, weight: 89.0
Edge from 3 to 13, weight: 76.0
Edge from 3 to 14, weight: 93.0
Edge from 3 to 15, weight: 95.0
Edge from 3 to 16, weight: 100.0
Edge from 3 to 17, weight: 104.0
```

```
Edge from 3 to 18, weight: 98.0
Edge from 3 to 19, weight: 57.0
Edge from 3 to 20, weight: 88.0
Edge from 3 to 21, weight: 99.0
Edge from 3 to 22, weight: 130.0
Edge from 3 to 23, weight: 100.0
Edge from 3 to 24, weight: 101.0
Edge from 3 to 25, weight: 179.0
Edge from 3 to 26, weight: 86.0
Edge from 3 to 27, weight: 51.0
Edge from 3 to 28, weight: 4.0
Edge from 3 to 29, weight: 18.0
Edge from 3 to 30, weight: 43.0
Edge from 3 to 31, weight: 45.0
Edge from 3 to 32, weight: 95.0
Edge from 3 to 33, weight: 45.0
Edge from 3 to 34, weight: 115.0
Edge from 3 to 35, weight: 93.0
Edge from 3 to 36, weight: 152.0
Edge from 3 to 37, weight: 159.0
Edge from 3 to 38, weight: 100.0
Edge from 3 to 39, weight: 112.0
Edge from 3 to 40, weight: 114.0
Edge from 3 to 41, weight: 153.0
Edge from 3 to 42, weight: 94.0
Edge from 4 to 4, weight: 0.0
Edge from 4 to 5, weight: 11.0
Edge from 4 to 6, weight: 48.0
Edge from 4 to 7, weight: 26.0
Edge from 4 to 8, weight: 54.0
Edge from 4 to 9, weight: 70.0
Edge from 4 to 10, weight: 94.0
Edge from 4 to 11, weight: 69.0
Edge from 4 to 12, weight: 89.0
Edge from 4 to 13, weight: 75.0
Edge from 4 to 14, weight: 84.0
Edge from 4 to 15, weight: 84.0
Edge from 4 to 16, weight: 89.0
Edge from 4 to 17, weight: 92.0
Edge from 4 to 18, weight: 89.0
Edge from 4 to 19, weight: 54.0
Edge from 4 to 20, weight: 78.0
Edge from 4 to 21, weight: 99.0
Edge from 4 to 22, weight: 141.0
Edge from 4 to 23, weight: 111.0
Edge from 4 to 24, weight: 109.0
Edge from 4 to 25, weight: 190.0
Edge from 4 to 26, weight: 89.0
Edge from 4 to 27, weight: 44.0
```

```
Edge from 4 to 28, weight: 11.0
Edge from 4 to 29, weight: 29.0
Edge from 4 to 30, weight: 54.0
Edge from 4 to 31, weight: 56.0
Edge from 4 to 32, weight: 89.0
Edge from 4 to 33, weight: 47.0
Edge from 4 to 34, weight: 118.0
Edge from 4 to 35, weight: 96.0
Edge from 4 to 36, weight: 147.0
Edge from 4 to 37, weight: 151.0
Edge from 4 to 38, weight: 90.0
Edge from 4 to 39, weight: 122.0
Edge from 4 to 40, weight: 126.0
Edge from 4 to 41, weight: 163.0
Edge from 4 to 42, weight: 101.0
Edge from 5 to 5, weight: 0.0
Edge from 5 to 6, weight: 40.0
Edge from 5 to 7, weight: 20.0
Edge from 5 to 8, weight: 58.0
Edge from 5 to 9, weight: 67.0
Edge from 5 to 10, weight: 92.0
Edge from 5 to 11, weight: 61.0
Edge from 5 to 12, weight: 78.0
Edge from 5 to 13, weight: 65.0
Edge from 5 to 14, weight: 76.0
Edge from 5 to 15, weight: 83.0
Edge from 5 to 16, weight: 89.0
Edge from 5 to 17, weight: 91.0
Edge from 5 to 18, weight: 95.0
Edge from 5 to 19, weight: 43.0
Edge from 5 to 20, weight: 72.0
Edge from 5 to 21, weight: 110.0
Edge from 5 to 22, weight: 141.0
Edge from 5 to 23, weight: 116.0
Edge from 5 to 24, weight: 105.0
Edge from 5 to 25, weight: 190.0
Edge from 5 to 26, weight: 81.0
Edge from 5 to 27, weight: 34.0
Edge from 5 to 28, weight: 19.0
Edge from 5 to 29, weight: 35.0
Edge from 5 to 30, weight: 57.0
Edge from 5 to 31, weight: 63.0
Edge from 5 to 32, weight: 97.0
Edge from 5 to 33, weight: 58.0
Edge from 5 to 34, weight: 129.0
Edge from 5 to 35, weight: 107.0
Edge from 5 to 36, weight: 156.0
Edge from 5 to 37, weight: 158.0
```

```
Edge from 5 to 38, weight: 92.0
Edge from

5 to 39, weight: 129.0
Edge from 5 to 40, weight: 127.0
Edge from 5 to 41, weight: 161.0
Edge from 5 to 42, weight: 95.0
Edge from 6 to 6, weight: 0.0
Edge from 6 to 7, weight: 23.0
Edge from 6 to 8, weight: 55.0
Edge from 6 to 9, weight: 96.0
Edge from 6 to 10, weight: 123.0
Edge from 6 to 11, weight: 78.0
Edge from 6 to 12, weight: 75.0
Edge from 6 to 13, weight: 62.0
Edge from 6 to 14, weight: 36.0
Edge from 6 to 15, weight: 56.0
Edge from 6 to 16, weight: 66.0
Edge from 6 to 17, weight: 63.0
Edge from 6 to 18, weight: 95.0
Edge from 6 to 19, weight: 37.0
Edge from 6 to 20, weight: 34.0
Edge from 6 to 21, weight: 137.0
Edge from 6 to 22, weight: 174.0
Edge from 6 to 23, weight: 156.0
Edge from 6 to 24, weight: 129.0
Edge from 6 to 25, weight: 224.0
Edge from 6 to 26, weight: 90.0
Edge from 6 to 27, weight: 15.0
Edge from 6 to 28, weight: 59.0
Edge from 6 to 29, weight: 75.0
Edge from 6 to 30, weight: 96.0
Edge from 6 to 31, weight: 103.0
Edge from 6 to 32, weight: 105.0
Edge from 6 to 33, weight: 91.0
Edge from 6 to 34, weight: 158.0
Edge from 6 to 35, weight: 139.0
Edge from 6 to 36, weight: 164.0
Edge from 6 to 37, weight: 156.0
Edge from 6 to 38, weight: 78.0
Edge from 6 to 39, weight: 169.0
Edge from 6 to 40, weight: 163.0
Edge from 6 to 41, weight: 191.0
Edge from 6 to 42, weight: 115.0
Edge from 7 to 7, weight: 0.0
Edge from 7 to 8, weight: 45.0
Edge from 7 to 9, weight: 85.0
Edge from 7 to 10, weight: 111.0
Edge from 7 to 11, weight: 75.0
Edge from 7 to 12, weight: 82.0
```

```
Edge from 7 to 13, weight: 69.0
Edge from 7 to 14, weight: 60.0
Edge from 7 to 15, weight: 63.0
Edge from 7 to 16, weight: 70.0
Edge from 7 to 17, weight: 71.0
Edge from 7 to 18, weight: 85.0
Edge from 7 to 19, weight: 44.0
Edge from 7 to 20, weight: 52.0
Edge from 7 to 21, weight: 115.0
Edge from 7 to 22, weight: 161.0
Edge from 7 to 23, weight: 136.0
Edge from 7 to 24, weight: 122.0
Edge from 7 to 25, weight: 210.0
Edge from 7 to 26, weight: 91.0
Edge from 7 to 27, weight: 25.0
Edge from 7 to 28, weight: 37.0
Edge from 7 to 29, weight: 54.0
Edge from 7 to 30, weight: 78.0
Edge from 7 to 31, weight: 81.0
Edge from 7 to 32, weight: 90.0
Edge from 7 to 33, weight: 68.0
Edge from 7 to 34, weight: 136.0
Edge from 7 to 35, weight: 116.0
Edge from 7 to 36, weight: 150.0
Edge from 7 to 37, weight: 147.0
Edge from 7 to 38, weight: 76.0
Edge from 7 to 39, weight: 148.0
Edge from 7 to 40, weight: 147.0
Edge from 7 to 41, weight: 180.0
Edge from 7 to 42, weight: 111.0
Edge from 8 to 8, weight: 0.0
Edge from 8 to 9, weight: 124.0
Edge from 8 to 10, weight: 149.0
Edge from 8 to 11, weight: 118.0
Edge from 8 to 12, weight: 126.0
Edge from 8 to 13, weight: 113.0
Edge from 8 to 14, weight: 80.0
Edge from 8 to 15, weight: 42.0
Edge from 8 to 16, weight: 42.0
Edge from 8 to 17, weight: 49.0
Edge from 8 to 18, weight: 40.0
Edge from 8 to 19, weight: 87.0
Edge from 8 to 20, weight: 60.0
Edge from 8 to 21, weight: 94.0
Edge from 8 to 22, weight: 195.0
Edge from 8 to 23, weight: 158.0
Edge from 8 to 24, weight: 163.0
Edge from 8 to 25, weight: 242.0
Edge from 8 to 26, weight: 135.0
Edge from 8 to 27, weight: 65.0
```

```
Edge from 8 to 28, weight: 63.0
Edge from 8 to 29, weight: 79.0
Edge from 8 to 30, weight: 106.0
Edge from 8 to 31, weight: 101.0
Edge from 8 to 32, weight: 50.0
Edge from 8 to 33, weight: 66.0
Edge from 8 to 34, weight: 118.0
Edge from 8 to 35, weight: 104.0
Edge from 8 to 36, weight: 109.0
Edge from 8 to 37, weight: 103.0
Edge from 8 to 38, weight: 36.0
Edge from 8 to 39, weight: 160.0
Edge from 8 to 40, weight: 178.0
Edge from 8 to 41, weight: 218.0
Edge from 8 to 42, weight: 153.0
Edge from 9 to 9, weight: 0.0
Edge from 9 to 10, weight: 28.0
Edge from 9 to 11, weight: 29.0
Edge from 9 to 12, weight: 68.0
Edge from 9 to 13, weight: 63.0
Edge from 9 to 14, weight: 122.0
Edge from 9 to 15, weight: 148.0
Edge from 9 to 16, weight: 155.0
Edge from 9 to 17, weight: 156.0
Edge from 9 to 18, weight: 159.0
Edge from 9 to 19, weight: 67.0
Edge from 9 to 20, weight: 129.0
Edge from 9 to 21, weight: 148.0
Edge from 9 to 22, weight: 78.0
Edge from 9 to 23, weight: 80.0
Edge from 9 to 24, weight: 39.0
Edge from 9 to 25, weight: 129.0
Edge from 9 to 26, weight: 46.0
Edge from 9 to 27, weight: 82.0
Edge from 9 to 28, weight: 65.0
Edge from 9 to 29, weight: 55.0
Edge from 9 to 30, weight: 40.0
Edge from 9 to 31, weight: 61.0
Edge from 9 to 32, weight: 157.0
Edge from 9 to 33, weight: 97.0
Edge from 9 to 34, weight: 159.0
Edge from 9 to 35, weight: 135.0
Edge from 9 to 36, weight: 212.0
Edge from 9 to 37, weight: 221.0
Edge from 9 to 38, weight: 159.0
Edge from 9 to 39, weight: 110.0
Edge from 9 to 40, weight: 72.0
Edge from 9 to 41, weight: 95.0
Edge from 9 to 42, weight: 35.0
Edge from 10 to 10, weight: 0.0
```

```
Edge from 10 to 11, weight: 54.0
Edge from 10 to 12, weight: 91.0
Edge from 10 to 13, weight: 88.0
Edge from 10 to 14, weight: 150.0
Edge from 10 to 15, weight: 174.0
Edge from 10 to 16, weight: 181.0
Edge from 10 to 17, weight: 182.0
Edge from 10 to 18, weight: 181.0
Edge from 10 to 19, weight: 95.0
Edge from 10 to 20, weight: 157.0
Edge from 10 to 21, weight: 159.0
Edge from 10 to 22, weight: 50.0
Edge from 10 to 23, weight: 65.0
Edge from 10 to 24, weight: 27.0
Edge from 10 to 25, weight: 102.0
Edge from 10 to 26, weight: 65.0
Edge from 10 to 27, weight: 110.0
Edge from 10 to 28, weight: 87.0
Edge from 10 to 29, weight: 73.0
Edge from 10 to 30, weight: 50.0
Edge from 10 to 31, weight: 68.0
Edge from 10 to 32, weight: 176.0
Edge from 10 to 33, weight: 112.0
Edge from 10 to 34, weight: 166.0
Edge from 10 to 35, weight: 142.0
Edge from 10 to 36, weight: 229.0
Edge from 10 to 37, weight: 241.0
Edge from 10 to 38, weight: 184.0
Edge from 10 to 39, weight: 99.0
Edge from 10 to 40, weight: 46.0
Edge from 10 to 41, weight: 69.0
Edge from 10 to 42, weight: 38.0
Edge from 11 to 11, weight: 0.0
Edge from 11 to 12, weight: 39.0
Edge from 11 to 13, weight: 34.0
Edge from 11 to 14, weight: 99.0
Edge from 11 to 15, weight: 134.0
Edge from 11 to 16, weight: 142.0
Edge from 11 to 17, weight: 141.0
Edge from 11 to 18, weight: 157.0
Edge from 11 to 19, weight: 44.0
Edge from 11 to 20, weight: 110.0
Edge from 11 to 21, weight: 161.0
Edge from 11 to 22, weight: 103.0
Edge from 11 to 23, weight: 109.0
Edge from 11 to 24, weight: 52.0
Edge from 11 to 25, weight: 154.0
Edge from 11 to 26, weight: 22.0
Edge from 11 to 27, weight: 63.0
Edge from 11 to 28, weight: 68.0
```

```
Edge from 11 to 29, weight: 66.0
Edge from 11 to 30, weight: 61.0
Edge from 11 to 31, weight: 81.0
Edge from 11 to 32, weight: 158.0
Edge from 11 to 33, weight: 107.0
Edge from 11 to 34, weight: 175.0
Edge from 11 to 35, weight: 151.0
Edge from 11 to 36, weight: 216.0
Edge from 11 to 37, weight: 219.0
Edge from 11 to 38, weight: 150.0
Edge from 11 to 39, weight: 137.0
Edge from 11 to 40, weight: 100.0
Edge from 11 to 41, weight: 115.0
Edge from 11 to 42, weight: 37.0
Edge from 12 to 12, weight: 0.0
Edge from 12 to 13, weight: 14.0
Edge from 12 to 14, weight: 80.0
Edge from 12 to 15, weight: 129.0
Edge from 12 to 16, weight: 139.0
Edge from 12 to 17, weight: 135.0
Edge from 12 to 18, weight: 167.0
Edge from 12 to 19, weight: 39.0
Edge from 12 to 20, weight: 98.0
Edge from 12 to 21, weight: 187.0
Edge from 12 to 22, weight: 136.0
Edge from 12 to 23, weight: 148.0
Edge from 12 to 24, weight: 81.0
Edge from 12 to 25, weight: 186.0
Edge from 12 to 26, weight: 28.0
Edge from 12 to 27, weight: 61.0
Edge from 12 to 28, weight: 92.0
Edge from 12 to 29, weight: 97.0
Edge from 12 to 30, weight: 98.0
Edge from 12 to 31, weight: 117.0
Edge from 12 to 32, weight: 173.0
Edge from 12 to 33, weight: 134.0
Edge from 12 to 34, weight: 204.0
Edge from 12 to 35, weight: 181.0
Edge from 12 to 36, weight: 232.0
Edge from 12 to 37, weight: 229.0
Edge from 12 to 38, weight: 153.0
Edge from 12 to 39, weight: 176.0
Edge from 12 to 40, weight: 137.0
Edge from 12 to 41, weight: 143.0
Edge from 12 to 42, weight: 62.0
Edge from 13 to 13, weight: 0.0
Edge from 13 to 14, weight: 72.0
Edge from 13 to 15, weight: 117.0
Edge from 13 to 16, weight: 128.0
Edge from 13 to 17, weight: 124.0
```

```
Edge from 13 to 18, weight: 153.0
Edge from 13 to 19, weight: 26.0
Edge from 13 to 20, weight: 88.0
Edge from 13 to 21, weight: 174.0
Edge from 13 to 22, weight: 136.0
Edge from 13 to 23, weight: 142.0
Edge from 13 to 24, weight: 82.0
Edge from 13 to 25, weight: 187.0
Edge from 13 to 26, weight: 32.0
Edge from 13 to 27, weight: 48.0
Edge from 13 to 28, weight: 79.0
Edge from 13 to 29, weight: 85.0
Edge from 13 to 30, weight: 89.0
Edge from 13 to 31, weight: 106.0
Edge from 13 to 32, weight: 159.0
Edge from 13 to 33, weight: 121.0
Edge from 13 to 34, weight: 191.0
Edge from 13 to 35, weight: 168.0
Edge from 13 to 36, weight: 219.0
Edge from 13 to 37, weight: 216.0
Edge from 13 to 38, weight: 140.0
Edge from 13 to 39, weight: 168.0
Edge from 13 to 40, weight: 134.0
Edge from 13 to 41, weight: 145.0
Edge from 13 to 42, weight: 64.0
Edge from 14 to 14, weight: 0.0
Edge from 14 to 15, weight: 59.0
Edge from 14 to 16, weight: 71.0
Edge from 14 to 17, weight: 63.0
Edge from 14 to 18, weight: 116.0
Edge from 14 to 19, weight: 56.0
Edge from 14 to 20, weight: 25.0
Edge from 14 to 21, weight: 170.0
Edge from 14 to 22, weight: 201.0
Edge from 14 to 23, weight: 189.0
Edge from 14 to 24, weight: 151.0
Edge from 14 to 25, weight: 252.0
Edge from 14 to 26, weight: 104.0
Edge from 14 to 27, weight: 44.0
Edge from 14 to 28, weight: 95.0
Edge from 14 to 29, weight: 111.0
Edge from 14 to 30, weight: 130.0
Edge from 14 to 31, weight: 138.0
Edge from 14 to 32, weight: 130.0
Edge from 14 to 33, weight: 127.0
Edge from 14 to 34, weight: 192.0
Edge from 14 to 35, weight: 174.0
Edge from 14 to 36, weight: 186.0
Edge from 14 to 37, weight: 172.0
Edge from 14 to 38, weight: 90.0
```

```
Edge from 14 to 39, weight: 205.0
Edge from 14 to 40, weight: 193.0
Edge from 14 to 41, weight: 214.0
Edge from 14 to 42, weight: 135.0
Edge from 15 to 15, weight: 0.0
Edge from 15 to 16, weight: 11.0
Edge from 15 to 17, weight: 8.0
Edge from 15 to 18, weight: 63.0
Edge from 15 to 19, weight: 93.0
Edge from 15 to 20, weight: 35.0
Edge from 15 to 21, weight: 135.0
Edge from 15 to 22, weight: 223.0
Edge from 15 to 23, weight: 195.0
Edge from 15 to 24, weight:

184.0
Edge from 15 to 25, weight: 273.0
Edge from 15 to 26, weight: 146.0
Edge from 15 to 27, weight: 71.0
Edge from 15 to 28, weight: 95.0
Edge from 15 to 29, weight: 113.0
Edge from 15 to 30, weight: 138.0
Edge from 15 to 31, weight: 138.0
Edge from 15 to 32, weight: 81.0
Edge from 15 to 33, weight: 107.0
Edge from 15 to 34, weight: 159.0
Edge from 15 to 35, weight: 146.0
Edge from 15 to 36, weight: 132.0
Edge from 15 to 37, weight: 113.0
Edge from 15 to 38, weight: 32.0
Edge from 15 to 39, weight: 200.0
Edge from 15 to 40, weight: 209.0
Edge from 15 to 41, weight: 243.0
Edge from 15 to 42, weight: 171.0
Edge from 16 to 16, weight: 0.0
Edge from 16 to 17, weight: 11.0
Edge from 16 to 18, weight: 54.0
Edge from 16 to 19, weight: 103.0
Edge from 16 to 20, weight: 46.0
Edge from 16 to 21, weight: 130.0
Edge from 16 to 22, weight: 230.0
Edge from 16 to 23, weight: 198.0
Edge from 16 to 24, weight: 192.0
Edge from 16 to 25, weight: 279.0
Edge from 16 to 26, weight: 155.0
Edge from 16 to 27, weight: 80.0
Edge from 16 to 28, weight: 99.0
Edge from 16 to 29, weight: 117.0
Edge from 16 to 30, weight: 143.0
Edge from 16 to 31, weight: 141.0
```

```
Edge from 16 to 32, weight: 74.0
Edge from 16 to 33, weight: 107.0
Edge from 16 to 34, weight: 155.0
Edge from 16 to 35, weight: 143.0
Edge from 16 to 36, weight: 122.0
Edge from 16 to 37, weight: 102.0
Edge from 16 to 38, weight: 22.0
Edge from 16 to 39, weight: 202.0
Edge from 16 to 40, weight: 215.0
Edge from 16 to 41, weight: 250.0
Edge from 16 to 42, weight: 179.0
Edge from 17 to 17, weight: 0.0
Edge from 17 to 18, weight: 65.0
Edge from 17 to 19, weight: 100.0
Edge from 17 to 20, weight: 39.0
Edge from 17 to 21, weight: 140.0
Edge from 17 to 22, weight: 232.0
Edge from 17 to 23, weight: 203.0
Edge from 17 to 24, weight: 192.0
Edge from 17 to 25, weight: 281.0
Edge from 17 to 26, weight: 153.0
Edge from 17 to 27, weight: 78.0
Edge from 17 to 28, weight: 103.0
Edge from 17 to 29, weight: 121.0
Edge from 17 to 30, weight: 147.0
Edge from 17 to 31, weight: 146.0
Edge from 17 to 32, weight: 85.0
Edge from 17 to 33, weight: 115.0
Edge from 17 to 34, weight: 164.0
Edge from 17 to 35, weight: 152.0
Edge from 17 to 36, weight: 133.0
Edge from 17 to 37, weight: 112.0
Edge from 17 to 38, weight: 33.0
Edge from 17 to 39, weight: 208.0
Edge from 17 to 40, weight: 218.0
Edge from 17 to 41, weight: 251.0
Edge from 17 to 42, weight: 178.0
Edge from 18 to 18, weight: 0.0
Edge from 18 to 19, weight: 127.0
Edge from 18 to 20, weight: 92.0
Edge from 18 to 21, weight: 83.0
Edge from 18 to 22, weight: 224.0
Edge from 18 to 23, weight: 180.0
Edge from 18 to 24, weight: 199.0
Edge from 18 to 25, weight: 269.0
Edge from 18 to 26, weight: 175.0
Edge from 18 to 27, weight: 106.0
Edge from 18 to 28, weight: 95.0
Edge from 18 to 29, weight: 109.0
```

```
Edge from 18 to 30, weight: 135.0
Edge from 18 to 31, weight: 125.0
Edge from 18 to 32, weight: 21.0
Edge from 18 to 33, weight: 80.0
Edge from 18 to 34, weight: 107.0
Edge from 18 to 35, weight: 100.0
Edge from 18 to 36, weight: 71.0
Edge from 18 to 37, weight: 63.0
Edge from 18 to 38, weight: 33.0
Edge from 18 to 39, weight: 173.0
Edge from 18 to 40, weight: 205.0
Edge from 18 to 41, weight: 249.0
Edge from 18 to 42, weight: 191.0
Edge from 19 to 19, weight: 0.0
Edge from 19 to 20, weight: 67.0
Edge from 19 to 21, weight: 153.0
Edge from 19 to 22, weight: 145.0
Edge from 19 to 23, weight: 139.0
Edge from 19 to 24, weight: 96.0
Edge from 19 to 25, weight: 196.0
Edge from 19 to 26, weight: 53.0
Edge from 19 to 27, weight: 23.0
Edge from 19 to 28, weight: 60.0
Edge from 19 to 29, weight: 70.0
Edge from 19 to 30, weight: 81.0
Edge from 19 to 31, weight: 95.0
Edge from 19 to 32, weight: 134.0
Edge from 19 to 33, weight: 101.0
Edge from 19 to 34, weight: 172.0
Edge from 19 to 35, weight: 149.0
Edge from 19 to 36, weight: 194.0
Edge from 19 to 37, weight: 190.0
Edge from 19 to 38, weight: 115.0
Edge from 19 to 39, weight: 160.0
Edge from 19 to 40, weight: 138.0
Edge from 19 to 41, weight: 159.0
Edge from 19 to 42, weight: 80.0
Edge from 20 to 20, weight: 0.0
Edge from 20 to 21, weight: 152.0
Edge from 20 to 22, weight: 207.0
Edge from 20 to 23, weight: 188.0
Edge from 20 to 24, weight: 162.0
Edge from 20 to 25, weight: 258.0
Edge from 20 to 26, weight: 119.0
Edge from 20 to 27, weight: 48.0
Edge from 20 to 28, weight: 89.0
Edge from 20 to 29, weight: 107.0
Edge from 20 to 30, weight: 129.0
Edge from 20 to 31, weight: 134.0
```

```
Edge from 20 to 32, weight: 108.0
Edge from 20 to 33, weight: 114.0
Edge from 20 to 34, weight: 176.0
Edge from 20 to 35, weight: 159.0
Edge from 20 to 36, weight: 163.0
Edge from 20 to 37, weight: 147.0
Edge from 20 to 38, weight: 66.0
Edge from 20 to 39, weight: 200.0
Edge from 20 to 40, weight: 197.0
Edge from 20 to 41, weight: 224.0
Edge from 20 to 42, weight: 147.0
Edge from 21 to 21, weight: 0.0
Edge from 21 to 22, weight: 188.0
Edge from 21 to 23, weight: 128.0
Edge from 21 to 24, weight: 184.0
Edge from 21 to 25, weight: 222.0
Edge from 21 to 26, weight: 183.0
Edge from 21 to 27, weight: 139.0
Edge from 21 to 28, weight: 95.0
Edge from 21 to 29, weight: 95.0
Edge from 21 to 30, weight: 110.0
Edge from 21 to 31, weight: 91.0
Edge from 21 to 32, weight: 62.0
Edge from 21 to 33, weight: 54.0
Edge from 21 to 34, weight: 24.0
Edge from 21 to 35, weight: 23.0
Edge from 21 to 36, weight: 81.0
Edge from 21 to 37, weight: 110.0
Edge from 21 to 38, weight: 113.0
Edge from 21 to 39, weight: 108.0
Edge from 21 to 40, weight: 164.0
Edge from 21 to 41, weight: 217.0
Edge from 21 to 42, weight: 184.0
Edge from 22 to 22, weight: 0.0
Edge from 22 to 23, weight: 65.0
Edge from 22 to 24, weight: 57.0
Edge from 22 to 25, weight: 51.0
Edge from 22 to 26, weight: 109.0
Edge from 22 to 27, weight: 160.0
Edge from 22 to 28, weight: 132.0
Edge from 22 to 29, weight: 116.0
Edge from 22 to 30, weight: 90.0
Edge from 22 to 31, weight: 102.0
Edge from 22 to 32, weight: 217.0
Edge from 22 to 33, weight: 148.0
Edge from 22 to 34, weight: 188.0
Edge from 22 to 35, weight: 168.0
Edge from 22 to 36, weight: 264.0
Edge from 22 to 37, weight: 281.0
```

```
Edge from 22 to 38, weight: 231.0
Edge from 22 to 39, weight: 100.0
Edge from 22 to 40, weight: 26.0
Edge from 22 to 41, weight: 30.0
Edge from 22 to 42, weight: 75.0
Edge from 23 to 23, weight: 0.0
Edge from 23 to 24, weight: 91.0
Edge from 23 to 25, weight: 94.0
Edge from 23 to 26, weight: 126.0
Edge from 23 to 27, weight: 145.0
Edge from 23 to 28, weight: 100.0
Edge from 23 to 29, weight: 82.0
Edge from 23 to 30, weight: 60.0
Edge from 23 to 31, weight: 57.0
Edge from 23 to 32, weight: 167.0
Edge from 23 to 33, weight: 99.0
Edge from 23 to 34, weight: 126.0
Edge from 23 to 35, weight: 106.0
Edge from 23 to 36, weight: 208.0
Edge from 23 to 37, weight: 230.0
Edge from 23 to 38, weight: 194.0
Edge from 23 to 39, weight: 36.0
Edge from 23 to 40, weight: 39.0
Edge from 23 to 41, weight: 94.0
Edge from 23 to 42, weight: 103.0
Edge from 24 to 24, weight: 0.0
Edge from 24 to 25, weight: 106.0
Edge from 24 to 26, weight: 53.0
Edge from 24 to 27, weight: 115.0
Edge from 24 to 28, weight: 104.0
Edge from 24 to 29, weight: 94.0
Edge from 24 to 30, weight: 74.0
Edge from 24 to 31, weight: 94.0
Edge from 24 to 32, weight: 196.0
Edge from 24 to 33, weight: 134.0
Edge from 24 to 34, weight: 192.0
Edge from 24 to 35, weight: 168.0
Edge from 24 to 36, weight: 251.0
Edge from 24 to 37, weight: 260.0
Edge from 24 to 38, weight: 197.0
Edge from 24 to 39, weight: 126.0
Edge from 24 to 40, weight: 64.0
Edge from 24 to 41, weight: 64.0
Edge from 24 to 42, weight: 19.0
Edge from 25 to 25, weight: 0.0
Edge from 25 to 26, weight: 158.0
Edge from 25 to 27, weight: 211.0
Edge from 25 to 28, weight: 180.0
Edge from 25 to 29, weight: 163.0
```

```
Edge from 25 to 30, weight: 136.0
Edge from 25 to 31, weight: 145.0
Edge from 25 to 32, weight: 259.0
Edge from 25 to 33, weight: 190.0
Edge from 25 to 34, weight: 218.0
Edge from 25 to 35, weight: 200.0
Edge from 25 to 36, weight: 302.0
Edge from 25 to 37, weight: 323.0
Edge from 25 to 38, weight: 278.0
Edge from 25 to 39, weight: 120.0
Edge from 25 to 40, weight: 65.0
Edge from 25 to 41, weight: 49.0
Edge from 25 to 42, weight: 124.0
Edge from 26 to 26, weight: 0.0
Edge from 26 to 27, weight: 75.0
Edge from 26 to 28, weight: 89.0
Edge from 26 to 29, weight: 88.0
Edge from 26 to 30, weight: 83.0
Edge from 26 to 31, weight: 103.0
Edge from 26 to 32, weight: 178.0
Edge from 26 to 33, weight: 129.0
Edge from 26 to 34, weight: 197.0
Edge from 26 to 35, weight: 173.0
Edge from 26 to 36, weight: 236.0
Edge from 26 to 37, weight: 238.0
Edge from 26 to 38, weight: 166.0
Edge from 26 to 39, weight: 156.0
Edge from 26 to 40, weight: 111.0
Edge from 26 to 41, weight: 115.0
Edge from 26 to 42, weight: 34.0
Edge from 27 to 27, weight: 0.0
Edge from 27 to 28, weight: 53.0
Edge from 27 to 29, weight: 68.0
Edge from 27 to 30, weight: 86.0
Edge from 27 to 31, weight: 95.0
Edge from 27 to 32, weight: 114.0
Edge from 27 to 33, weight: 90.0
Edge from 27 to 34, weight: 160.0
Edge from 27 to 35, weight: 139.0
Edge from 27 to 36, weight: 173.0
Edge from 27 to 37, weight: 168.0
Edge from 27 to 38, weight: 92.0
Edge from 27 to 39, weight: 162.0
Edge from 27 to 40, weight: 150.0
Edge from 27 to 41, weight: 176.0
Edge from 27 to 42, weight: 101.0
Edge from 28 to 28, weight: 0.0
Edge from 28 to 29, weight: 18.0
Edge from 28 to 30, weight: 44.0
```

```
Edge from 28 to 31, weight: 45.0
Edge from 28 to 32, weight: 92.0
Edge from 28 to 33, weight: 42.0
Edge from 28 to 34, weight: 112.0
Edge from 28 to 35, weight: 89.0
Edge from 28 to 36, weight: 149.0
Edge from 28 to 37, weight: 156.0
Edge from 28 to 38, weight: 99.0
Edge from 28 to 39, weight: 111.0
Edge from 28 to 40, weight: 116.0
Edge from 28 to 41, weight: 155.0
Edge from 28 to 42, weight: 97.0
Edge from 29 to 29, weight: 0.0
Edge from 29 to 30, weight: 27.0
Edge from 29 to 31, weight: 27.0
Edge from 29 to 32, weight: 103.0
Edge from 29 to 33, weight: 42.0
Edge from 29 to 34, weight: 109.0
Edge from 29 to 35, weight: 85.0
Edge from 29 to 36, weight: 157.0
Edge from 29 to 37, weight: 168.0
Edge from 29 to 38, weight: 115.0
Edge from 29 to 39, weight: 94.0
Edge from 29 to 40, weight: 98.0
Edge from 29 to 41, weight: 140.0
Edge from 29 to 42, weight:

90.0
Edge from 30 to 30, weight: 0.0
Edge from 30 to 31, weight: 21.0
Edge from 30 to 32, weight: 128.0
Edge from 30 to 33, weight: 62.0
Edge from 30 to 34, weight: 119.0
Edge from 30 to 35, weight: 96.0
Edge from 30 to 36, weight: 179.0
Edge from 30 to 37, weight: 192.0
Edge from 30 to 38, weight: 142.0
Edge from 30 to 39, weight: 79.0
Edge from 30 to 40, weight: 72.0
Edge from 30 to 41, weight: 115.0
Edge from 30 to 42, weight: 74.0


Edge from 31 to 31, weight: 0.0
Edge from 31 to 32, weight: 115.0
Edge from 31 to 33, weight: 46.0
Edge from 31 to 34, weight: 98.0
Edge from 31 to 35, weight: 75.0
Edge from 31 to 36, weight: 163.0
Edge from 31 to 37, weight: 179.0
```

```
Edge from 31 to 38, weight: 136.0
Edge from 31 to 39, weight: 67.0
Edge from 31 to 40, weight: 81.0
Edge from 31 to 41, weight: 129.0
Edge from 31 to 42, weight: 95.0
Edge from 32 to 32, weight: 0.0
Edge from 32 to 33, weight: 69.0
Edge from 32 to 34, weight: 86.0
Edge from 32 to 35, weight: 81.0
Edge from 32 to 36, weight: 60.0
Edge from 32 to 37, weight: 65.0
Edge from 32 to 38, weight: 54.0
Edge from 32 to 39, weight: 158.0
Edge from 32 to 40, weight: 195.0
Edge from 32 to 41, weight: 243.0
Edge from 32 to 42, weight: 190.0
Edge from 33 to 33, weight: 0.0
Edge from 33 to 34, weight: 71.0
Edge from 33 to 35, weight: 49.0
Edge from 33 to 36, weight: 117.0
Edge from 33 to 37, weight: 133.0
Edge from 33 to 38, weight: 98.0
Edge from 33 to 39, weight: 95.0
Edge from 33 to 40, weight: 127.0
Edge from 33 to 41, weight: 175.0
Edge from 33 to 42, weight: 132.0
Edge from 34 to 34, weight: 0.0
Edge from 34 to 35, weight: 24.0
Edge from 34 to 36, weight: 94.0
Edge from 34 to 37, weight: 127.0
Edge from 34 to 38, weight: 137.0
Edge from 34 to 39, weight: 100.0
Edge from 34 to 40, weight: 163.0
Edge from 34 to 41, weight: 218.0
Edge from 34 to 42, weight: 194.0
Edge from 35 to 35, weight: 0.0
Edge from 35 to 36, weight: 104.0
Edge from 35 to 37, weight: 133.0
Edge from 35 to 38, weight: 127.0
Edge from 35 to 39, weight: 85.0
Edge from 35 to 40, weight: 143.0
Edge from 35 to 41, weight: 197.0
Edge from 35 to 42, weight: 170.0
Edge from 36 to 36, weight: 0.0
Edge from 36 to 37, weight: 39.0
Edge from 36 to 38, weight: 100.0
Edge from 36 to 39, weight: 190.0
Edge from 36 to 40, weight: 241.0
Edge from 36 to 41, weight: 292.0
```

```
Edge from 36 to 42, weight: 246.0
Edge from 37 to 37, weight: 0.0
Edge from 37 to 38, weight: 81.0
Edge from 37 to 39, weight: 216.0
Edge from 37 to 40, weight: 259.0
Edge from 37 to 41, weight: 307.0
Edge from 37 to 42, weight: 253.0
Edge from 38 to 38, weight: 0.0
Edge from 38 to 39, weight: 193.0
Edge from 38 to 40, weight: 214.0
Edge from 38 to 41, weight: 253.0
Edge from 38 to 42, weight: 187.0
Edge from 39 to 39, weight: 0.0
Edge from 39 to 40, weight: 74.0
Edge from 39 to 41, weight: 129.0
Edge from 39 to 42, weight: 137.0
Edge from 40 to 40, weight: 0.0
Edge from 40 to 41, weight: 55.0
Edge from 40 to 42, weight: 80.0
Edge from 41 to 41, weight: 0.0
Edge from 41 to 42, weight: 81.0
Edge from 42 to 42, weight: 0.0
```

Dans le cas où le format n'est pas de type `FULL_MATRIX`, on renvoie un message d'erreur.

```
build_graph("/instances/stsp/dantzig42.tsp", "Graph_Test")

┌ Warning: edge weight format must be `FULL_MATRIX`
└ @ Main c:\Users\victo\OneDrive\Documents\Cours\MTH6412B\TP\Projet\
Phase 1\Phase 1.ipynb:10

("Current format is :", "LOWER_DIAG_ROW")
```

Question 7)

c.f fichier `main.jl` à l'url : https://github.com/nathanemac/Projet/tree/phase1/Phase%201

Très bien ! tes comentaires sont des détail. Pour vous aider en Julia