《高级算法》课程大作业

无人机配送路径规划问题

学号： 2023202210111

姓名： 甘泽昊

专业： 网络空间安全

班级： 3 班

目录

1. 引言

无人机技术的快速发展为物流行业带来了革命性的变化，尤其在最后一公里配送领域。无人机通过其灵活、高效的特性，能够有效解决传统配送方式中存在的许多难题，如交通拥堵、配送时间长和配送成本高等问题。作为一种新兴的配送方式，无人机配送不仅可以大幅提高配送效率，还能显著提升用户的满意度，因而受到了广泛关注。

近年来，随着电子商务的迅猛发展，消费者对快速配送的需求日益增加。传统的配送方式往往受限于道路交通和人力成本，难以在短时间内满足大量的配送需求。无人机的应用则为解决这一难题提供了新的思路。通过空中路线，无人机可以避开地面交通，实现快速、高效的货物传递，尤其在城市环境中优势更加明显。

本报告旨在探讨无人机配送路径规划问题，具体研究如何设计一种高效的算法，以最小化总配送路径，同时满足各种订单的优先级需求。在这一过程中，我们将详细介绍问题的背景、建模方法、算法设计和仿真验证，并对算法的性能进行分析和讨论。

首先，我们将对无人机配送路径规划问题进行详细定义，明确配送区域、配送中心和卸货点的设置，订单生成机制及其优先级划分。接着，我们会列出问题中涉及的假设和约束条件，以确保算法设计符合实际应用场景。在此基础上，我们将构建数学模型，定义相关变量、目标函数和约束条件。

随后，我们会详细介绍算法的设计原理及具体实现步骤，包括初始化处理队列和候补队列、订单分类和处理、路径规划和优化等内容。特别地，我们将结合具体的算法，如贪心算法、启发式算法和局部搜索算法，来优化配送路径，并通过仿真实验验证算法的有效性。

在仿真部分，我们会展示实验的设计和结果，通过数据和图表分析算法的性能。最后，我们将讨论算法在实际应用中的挑战和局限性，并提出改进建议和未来研究方向。

2. 问题定义

在无人机配送路径规划问题中，需要设计一种高效的算法来优化无人机的配送路径，使总配送距离最小化，同时满足各种订单的优先级需求。为了更清晰地描述问题，我们将从配送区域的设置、订单生成机制及其优先级划分等方面详细定义问题。

2.1 配送区域设置

在本问题中，我们假设一个固定的配送区域，该区域内存在多个配送中心和卸货点。具体设置如下：

- **配送中心 (Depots)**：配送中心是无人机的起始点和返回点，假设在该区域中共有 j 个配送中心。每个配送中心拥有无限数量的无人机和货物，能够随时响应订单需求。

- **卸货点 (Delivery Points)**：卸货点是无人机的配送终点，即无人机将货物配送到指定的卸货点即可。假设在该区域中共有 k 个卸货点。

2.2 订单生成机制及优先级划分

在实际应用中，订单的生成和配送需求是动态变化的。为了模拟这一过程，我们将时间离散化，即每隔 t 分钟，所有卸货点会生成订单。每个订单包含一个商品，并具有相应的优先级。具体优先级划分如下：

- **一般订单 (General Orders)**：要求在 3 小时内完成配送。
- **较紧急订单 (Urgent Orders)**：要求在 1.5 小时内完成配送。
- **紧急订单 (Emergency Orders)**：要求在 0.5 小时内完成配送。

订单生成时，每个卸货点会随机生成 0 到 m 个订单。系统每隔 t 分钟需要进行一次决策，包括以下内容：

1. 决定哪些配送中心出动多少无人机来完成哪些订单；

2. 为每个无人机规划具体路径，即先完成哪个订单，再完成哪个订单，最后返回原来的配送中心。

系统在进行决策时，可以选择不对当前的某些订单进行配送，因为某些订单的紧急程度不高，可以累积后与后续订单一起配送。

2.3　目标与约束条件

目标：在一个固定时间段内（例如一天），使所有无人机的总配送路径最短。

约束条件：满足所有订单的优先级要求，即各类订单在规定的时间内完成配送。

为了实现上述目标，我们需要考虑以下假设条件：

1. **无人机载货能力**：每架无人机一次最多只能携带 n 个物品。

2. **无人机飞行距离限制**：每架无人机一次飞行的最远距离为 20 公里（包括返回配送中心）。

3. **无人机速度**：无人机的飞行速度为 60 公里/小时。

4. **配送中心的无人机数量无限**：每个配送中心都拥有足够的无人机，随时可以出动执行配送任务。

5. **配送中心的货物供应无限**：任意一个配送中心都能够满足用户的订货需求，货物数量视为无限。

综上所述，目前已经明确了无人机配送路径规划问题的具体设置、订单生成机制及优先级划分，以及目标与约束条件。下一章节，我们将进一步详细介绍问题的建模方法，包括变量和参数的定义、目标函数的构建以及约束条件的数学表达。

3. 问题建模

3.1　假设和约束条件

在无人机配送路径规划问题中，假设和约束条件是保证算法设计与实际应用相符的关键部分。为了确保算法能够在真实环境中有效运行，我们需要明确以下假设和约束条件：

1. **无人机载货能力**：假设每架无人机在一次配送过程中最多只能携带 n 个物品。这意味着在规划无人机路径时，需要确保每架无人机所配送的订单总数不超过其最大载货能力。

2. **无人机飞行距离限制**：每架无人机一次飞行的最远距离为 20 公里。这包括从配送中心出发，经过多个卸货点完成订单，再返回配送中心的总距离。因此，在路径规划时，需要确保每条路径的总长度不超过这一限制，以避免无人机在配送过程中因电量不足而无法完成任务。

3. **无人机速度**：无人机的飞行速度为 60 公里/小时。根据不同订单的优先级，这一速度将影响订单的配送时间。我们需要根据无人机的速度来计算不同优先级订单的最晚起飞时间，以确保所有订单能够在规定时间内完成配送。

4. **配送中心的无人机数量无限**：假设每个配送中心拥有无限数量的无人机。这意味着在每个决策周期内，配送中心可以根据需要随时派出足够数量的无人机来完成订单，无需考虑无人机的数量限制。

5. **配送中心的货物供应无限**： 假设任意一个配送中心都能满足用户的订货需求，货物数量视为无限。这确保了配送中心能够随时提供所需的物品进行配送，不会出现因货物短缺而无法完成订单的情况。

3.2 数学建模

为了设计高效的无人机配送路径规划算法，我们需要将问题进行数学建模，以帮助我们明确问题的变量、参数、目标函数和约束条件，为后续的算法设计提供理论基础。

3.2.1 变量和参数定义

➢ **配送中心和卸货点**：

● $D = \{d_1, d_2, ..., d_j\}$：配送中心集合
● $P = \{p_1, p_2, ..., p_k\}$：卸货点集合

➢ **订单**：

- $O = \{o_1, o_2, \ldots, o_m\}$:订单集合，每个订单由三元组$(p_i, w, t_{deadline})$表示，其中$p_i$为卸货点，$w$为订单权重(优先级), $t_{deadline}$为订单最晚配送时间

➢ **变量：**

- x_{ij}：二元决策变量，表示无人机是否从点 i 飞到点 j

- y_i：二元决策变量，表示无人机是否访问卸货点 p_i

- z_k：整数变量，表示无人机 k 的路径

3.2.2 目标函数

我们的目标是最小化所有无人机在规定时间内的总配送路径。具体的目标函数可以表示为：

$$\min \sum_{i \in DUP} \sum_{j \in DUP} c_{ij} x_{ij}$$

其中，c_{ij} 表示点 i 和点 j 之间的距离。

3.2.3 约束条件

- 路径约束：每条路径的总距离不能超过无人机的最大飞行距离 20 公里。

$$\sum_{i \in DUP} \sum_{j \in DUP} c_{ij} x_{ij} \leq 20$$

- 载货能力约束：每架无人机在一次配送过程中最多只能携带 n 个物品。

$$\sum_{o \in O} y_o \leq n$$

- 时间约束：每个订单必须在其最晚配送时间前完成。

$$t_{ij} + t_{ji} \leq t_{deadline}$$

- 节点访问约束：每个卸货点必须被访问一次。

$$\sum_{j \in P} x_{ij} = 1, \forall i \in P$$

- 连续性约束：确保路径的连续性，即从某一点出发的无人机必须到达某一点。

$$\sum_{j \in P} x_{ij} = \sum_{j \in P} x_{ji}, \forall i \in D \cup P$$

- 起点和终点约束：无人机必须从配送中心出发并返回配送中心

$$\sum_{j \in P} x_{dj} = \sum_{j \in P} x_{jd}, \forall d \in D$$

3.2.4 距离计算

使用欧几里得距离计算配送中心和卸货点之间的距离：

$$d_{ij} = \sqrt{\left(x_i - x_j\right)^2 + \left(y_i - y_j\right)^2}$$

其中，(x_i, y_i) 和 (x_j, y_j) 分别表示点 i 和点 j 的坐标。

3.2.5 订单优先级处理

根据订单的紧急程度，设定不同的时间窗：

- 紧急订单：必须在 0.5 小时内完成
- 较紧急订单：必须在 1.5 小时内完成
- 一般订单：必须在 3 小时内完成

设定优先级权重 w：

$$w_{emergency} > w_{urgent} > w_{general}$$

目标函数可以进一步扩展，以考虑订单的优先级：

$$\min \sum_{i \in D \cup P} \sum_{j \in D \cup P} c_{ij} x_{ij} + \sum_{o \in O} w_o y_o$$

其中，w_o 表示订单 o 的优先级权重。综上所述，我们通过定义变量和参数，构建目标函数，并明确约束条件，完成了问题的数学建模。

接下来，我们将详细介绍算法设计，包括初始化步骤、订单分类和处理、路径规划等内容。

4. 算法设计

为了最小化总配送路径，并确保所有订单按照优先级要求完成配送，我们需要详细设计调度算法。该算法将包括初始化、订单分类、订单处理、路径规划等步骤。

4.1 初始化

初始化阶段的目的是为后续的订单处理和调度做准备。我们需要初始化处理队列和候补队列，以便对订单进行有序管理和调度。

- **处理队列**：用于立即处理高优先级订单，确保紧急订单能够尽快得到处理。

- **候补队列**：用于存储不同优先级的订单，便于在处理队列订单不足时补充无人机的负载，并在后续时间周期中逐步提升订单的优先级。

初始化过程包括以下步骤：

1. 创建处理队列和候补队列。

2. 读取初始订单信息，并根据订单的优先级分类到相应的队列中。

4.2 订单分类

根据订单的优先级，将订单分类到相应的队列中，以便后续处理和调度。

- **紧急订单**：直接进入处理队列。

- **较紧急订单**：进入紧急队列 2，为后续的优先级提升做准备。

- **一般订单**：进入一般队列 3，等待后续时间周期的优先级提升和处理。

算法 1：初始化订单(订单列表)

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1 创建 处理队列

2 创建 候补队列 {'紧急': [], '较紧急 1': [], '较紧急 2': [], '一般 1': [], '一般 2': [], '一般 3': []}

3 对于 每个订单 在 订单列表 中：

4   如果 订单.优先级 == '紧急'：

5	将 订单 添加到 处理队列
6	**否则如果** 订单.优先级 == '较紧急':
7	将 订单 添加到 候补队列['较紧急 2']
8	**否则**:
9	将 订单 添加到 候补队列['一般 3']
10	**返回** 处理队列 和 候补队列

4.3 订单处理

在每个时间周期内，系统需要处理当前周期内的订单，确保无人机的高效利用，同时满足订单的优先级要求。

订单处理过程包括以下步骤：

1. **处理处理队列中的订单**：优先处理高优先级订单，确保紧急需求得到满足。

2. **检查无人机容量并从候补队列补充订单**：优化无人机的利用率，减少空载飞行。

3. **优先从紧急队列 1 中选择订单**：确保较紧急的订单能尽快处理。

4. **如果紧急队列 1 为空**：依次选择紧急队列和一般队列中的订单，逐步降低优先级。

算法 2：处理订单(无人机列表, 处理队列, 候补队列, 最大载荷)

1	**对于** 每个无人机 **在** 无人机列表 **中**:
2	初始化 负载 为 0
3	**当** 负载 < 最大载荷 **且** 处理队列 不为空 **时**:
4	从 处理队列 弹出 一个订单
5	将 订单 分配给 无人机
6	增加 负载
7	将 订单 添加到 候补队列['较紧急 2']
8	**当** 负载 < 最大载荷:
9	**对于** 每个优先级 **在** ['紧急', '较紧急', '一般'] **中**:
10	**当** 负载 < 最大载荷 **且** 候补队列[优先级] 不为 空 **时**:
11	从 候补队列[优先级] 弹出 一个订单

12		将 订单 分配给 无人机
13		增加 负载
10	返回	无人机列表

4.4　路径规划

　　路径规划是无人机配送路径规划算法设计中的核心部分。为了实现最优路径规划，我们采用多种启发式算法和局部搜索算法，包括最近邻算法、Clarke-Wright 节约算法、贪心算法以及 2-opt 和 3-opt 算法。这些算法通过不同的策略和步骤，逐步优化路径，最终实现总配送距离的最小化。

4.4.1　最近邻算法（Nearest Neighbor Algorithm）

　　最近邻算法是一种简单而有效的启发式方法，常用于解决旅行商问题（TSP）及其变种。在无人机配送路径规划中，最近邻算法通过选择距离当前节点最近的未访问节点来优化路径，从而构建出一条近似最优的路径。

　　在优化路径时，通过选择每个节点到下一个节点的最短距离，逐步构建路径，直到满足最大距离约束或无人机载荷限制。整个过程大致如下：

1. 从起点（配送中心）开始。
2. 每次选择距离当前节点最近的未访问节点，加入路径。
3. 继续选择直到所有节点都被访问或满足无人机限制。

算法 3：最近邻算法(节点列表，距离矩阵)
1　创建 空路径
2　将 起点 添加到 路径
3　标记 起点 为已访问
4　当前节点 = 起点
5　**当** 存在 未访问的节点:
6　　找到距离 当前节点 最近的未访问节点
7　　将 最近节点 添加到 路径
8　　标记 最近节点 为已访问
9　　当前节点 = 最近节点

4.4.2 Clarke-Wright 节约算法（**Clarke-Wright Savings Algorithm**）

Clarke-Wright 节约算法是一种常用的启发式方法，通过计算节点之间的节约距离，逐步合并路线，减少总行驶距离。这种方法在路径规划中应用广泛，特别是适用于多节点路径优化问题。

关键点如下：

- **距离矩阵计算**：通过计算所有节点之间的距离矩阵来准备节约算法的数据。

- **节约计算和路径合并**：在路径规划过程中，逐步合并节约距离最大的路线，形成最终的路径方案。

整个过程描述如下：

1. 计算每个节点的单独路径的总距离。

2. 计算合并两个节点的路径可以节省的距离（Savings）。

3. 按照节省的距离从大到小排序。

4. 逐步合并节省距离最大的路线，直到所有节点都被访问。

算法 4：Clarke-Wright 节约算法(节点列表, 距离矩阵)

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1 创建 路径列表，初始每个节点 为 一个独立路径

2 创建 节约列表

3 **对于** 每对节点(i, j) 计算 节约距离:

4 节约 = 距离矩阵[起点][i] + 距离矩阵[起点][j] - 距离矩阵[i][j]

5 将 (节约, i, j) 添加到 节约列表

6 **按照** 节约值 **从大到小排序** 节约列表

7 **对于** 每个 (节约, i, j) **在** 节约列表 **中:**

8 **如果** 路径列表[i] 和 路径列表[j] 不冲突:

9 合并 路径列表[i] 和 路径列表[j]

10 **返回** 路径列表

4.4.3 贪心算法（Greedy Algorithm）

贪心算法是一种通过逐步选择当前最优解以期望达到全局最优解的算法。在路径优化和订单调度过程中，贪心算法优先选择最优解，以局部最优解逐步逼近全局最优解。

关键点如下：

- **订单调度**：在处理队列中，贪心地优先选择高优先级订单进行处理，确保紧急订单得到及时响应。
- **路径选择**：在路径优化过程中，贪心地选择最近的节点加入路径，减少总配送距离。

整个过程大致如下：

1. 优先处理高优先级订单，确保紧急订单得到及时响应。
2. 检查无人机容量，并从候补队列中选择合适的订单补充到无人机，优先选择较高优先级的订单。

算法 5：贪心算法(订单列表, 无人机列表, 最大载荷)

1　**按照** 优先级 **对** 订单列表 **排序：**

2　**对于** 每个无人机 **在** 无人机列表 **中：**

3　　　初始化 负载 **为** 0

4　　　**当** 负载 < 最大载荷 **且** 存在 未处理订单 **时：**

5　　　　　选择 最高优先级的订单

6　　　　　将 订单 分配给 无人机

7　　　　　增加 负载

8　　**返回** 无人机列表

4.4.4 路径优化（使用 2-opt 和 3-opt）

在路径优化过程中，2-opt 和 3-opt 算法通过调整路径中的边以减少总配送距离。这些局部搜索算法能够有效地改善初始解，进一步优化路径。通过移除路径中的两条或三条边，并以不同方式重新连接这些边，检查是否可以减少总距离。整个过程大致如下：

1. 对于每条路径，选择两条或三条边进行移除。

2. 以不同方式重新连接这些边，生成新路径。

3. 如果新路径的总距离小于原路径，则接受新路径。

算法 6：二选优化(路径, 距离矩阵)

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1 最佳路径 ＝ 路径

2 最佳距离 ＝ 计算总距离(路径, 距离矩阵)

3 对于 i 从 1 到 路径长度 - 2:

4   对于 j 从 i＋1 到 路径长度:

5   新路径 ＝ 路径[:i] ＋ 路径[i:j][逆序] ＋ 路径[j:]

6   新距离 ＝ 计算总距离(新路径, 距离矩阵)

7   **如果** 新距离 ＜ 最佳距离:

8   最佳路径 ＝ 新路径

9   最佳距离 ＝ 新距离

10 返回 最佳路径

算法 7：三选优化(路径, 距离矩阵)

---

1 最佳路径 ＝ 路径

2 最佳距离 ＝ 计算总距离(路径, 距离矩阵)

3 对于 i 从 1 到 路径长度 - 3:

4   对于 j 从 i＋1 到 路径长度-2:

5   对于 k 从 k＋1 到 路径长度:

6   新路径 ＝ 路径[:i] ＋ 路径[i:j][逆序] ＋ 路径[j:]

7   新距离 ＝ 计算总距离(新路径, 距离矩阵)

8   **如果** 新距离 ＜ 最佳距离:

9   最佳路径 ＝ 新路径

10   最佳距离 ＝ 新距离

11 返回 最佳路径

4.5 距离约束的强制执行

在路径规划完成后，为了确保无人机能够在实际的配送任务中有效执行，我们需要对路径进行距离约束的强制执行。这一步骤至关重要，因为无人机的飞行距离有限，如果路径超过了无人机的最大飞行距离，将会导致任务失败。因此，我们必须确保每条路径的总距离不超过无人机的最大飞行距离。

步骤如下：

1. **路径距离检查**：
   - 对于每条生成的路径，计算其总距离。
   - 如果路径的总距离小于或等于无人机的最大飞行距离，则该路径为有效路径。
   - 如果路径的总距离超过无人机的最大飞行距离，则需要进一步处理。

2. **移除最远节点**：
   - 当路径距离超出限制时，首先找到路径中距离最远的节点。
   - 将该节点从路径中移除，重新计算路径总距离。
   - 继续移除最远节点，直到路径总距离符合约束。

3. **路径调整**：
   - 在移除节点后，如果路径不再满足任务要求（如必须访问的节点被移除），需要对路径进行调整。
   - 通过重新分配未完成的订单到其他路径或创建新的路径，以确保所有订单都能被有效处理。

4. **重复验证**：
   - 对所有调整后的路径进行重新验证，确保每条路径的总距离均在无人机的最大飞行距离范围内。

我们通过强制执行距离约束，避免无人机因飞行距离超限而无法完成配送任务。同时，路径优化和距离约束确保路径在物理限制内，使得无人机可以高效地完成配送任务。

算法 8：强制执行距离约束(路径列表, 最大飞行距离)

1	**对于** 每条路径 **在** 路径列表 **中:**
2	计算 路径的总距离
3	**如果** 总距离 > 最大飞行距离:
4	**当** 总距离 > 最大飞行距离 **时:**
5	找到 路径中距离最远的节点
6	移除 该节点
7	重新计算 路径的总距离
8	**返回** 路径列表

4.6　综合应用步骤

为了实现无人机配送路径规划的最优解，我们需要综合应用多种启发式算法和局部搜索算法。这些算法在不同的步骤中发挥各自的优势，共同作用以提高路径规划的效率和效果。我们按照整个解决方案的运行顺序总结算法的应用。

4.6.1　初始解生成

选择适当的初始解策略，如最近邻算法生成初始路径。初始化求解参数是路径规划的第一步，通过选定合理的初始解策略，为后续的优化过程奠定基础。

通过最近邻算法生成初始路径，确保路径的基本合理性。最近邻算法通过选择距离最近的未访问节点，快速生成初始路径，保证路径在初始阶段的合理性。

- **过程：**
  1. 从起点（配送中心）开始。
  2. 每次选择距离当前节点最近的未访问节点，加入路径。
  3. 继续选择直到所有节点都被访问或满足无人机限制。
- **目的：** 快速生成一个初步可行的路径，为进一步优化提供基础。

- **方法**：采用最近邻算法，从起点开始，每次选择距离最近的未访问节点，逐步构建初始路径。

4.6.2 应用 Clarke-Wright 节约算法

通过 Clarke-Wright 节约算法进一步优化初始路径，减少总行驶距离。该算法通过计算节点之间的节约距离，逐步合并路线，实现路径的优化。

- **过程：**

  1. 计算每个节点的单独路径的总距离。

  2. 计算合并两个节点的路径可以节省的距离（Savings）。

  3. 按照节省的距离从大到小排序。

  4. 逐步合并节省距离最大的路线，直到所有节点都被访问。

4.6.3 订单调度

使用贪心算法优先处理高优先级订单，确保订单的及时响应。贪心算法在订单调度过程中，优先选择当前最优解，以确保高优先级订单得到及时处理。

- **过程：**

  1. 优先处理高优先级订单，确保紧急订单得到及时响应。

  2. 检查无人机容量，并从候补队列中选择合适的订单补充到无人机，优先选择较高优先级的订单。

4.6.4 路径优化

应用 2-opt 和 3-opt 算法，通过局部调整进一步减少总距离，提高路径优化效果。这些局部搜索算法通过调整路径中的边，进一步优化路径。

- **过程：**

  1. 对于每条路径，选择两条或三条边进行移除。

  2. 以不同方式重新连接这些边，生成新路径。

  3. 如果新路径的总距离小于原路径，则接受新路径。

4.6.5 路径提取与优化

从求解结果中提取路径信息，检查每条路径的总距离。如果路径距离超过无人机的最大飞行距离，移除路径中最远的节点或调整路径，确保总距离符合约束。

- **目的**：确保路径信息用于实际执行配送任务，路径优化和距离约束确保路径在物理限制内，提高配送效率和可靠性。

4.6.6 距离约束的强制执行

强制确保每条路径的总距离不超过无人机的最大飞行距离。如果路径距离仍然超出限制，移除路径中最远的节点，直到符合约束。

- **目的**：确保路径方案的可行性，避免无人机因飞行距离超限而无法完成配送任务。

通过按顺序运行这些算法，我们能够有效地规划无人机的配送路径，确保在满足约束条件的前提下，最小化总配送距离，提高配送效率。这些算法相互结合，通过不同的优化策略和步骤，逐步提高路径规划的效果，实现全局最优解。

5. 算法实现与仿真

5.1 仿真环境和参数设置

为了验证算法的有效性和性能，我们需要在仿真环境中运行算法。仿真环境的设置包括配送区域的划分、配送中心和卸货点的位置、订单生成的频率和数量等参数。

1. **配送区域**：设定一个固定的矩形区域，内部分布若干配送中心和卸货点。
   - 配送中心位置：centers = [(-10, 0), (0, 10), (10, 0), (0, -10), (15, 10)]
   - 每个配送中心的卸货点数量：num_depots_per_center = 10
   - 卸货点半径：radius = 10

2. 订单生成：

- 每个卸货点的最大订单数：m = 5（每次生成由 1-5 随机取值）
- 订单生成频率：每 30 分钟生成一次订单 t = 30
- 订单优先级分布：60%普通，30%较紧急，10%紧急

3. 无人机设置：

- 无人机速度：drone_speed = 60 公里/小时
- 每个配送中心每次配送的最少订单数：min_orders_per_center = 10
- 无人机最大飞行距离：20 公里

4. 工作时间：

- 一天工作时间：8 小时（480 分钟）

生成的 50 个卸货点数据见附录 A。其图像展示如下：

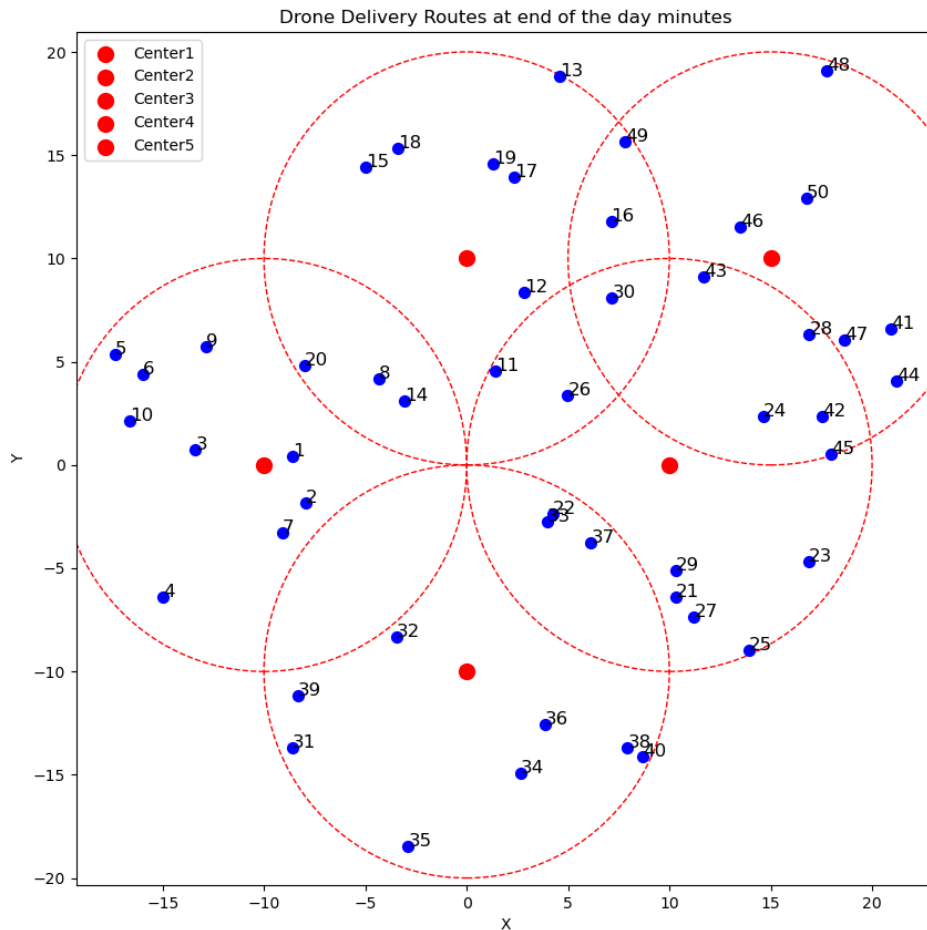图 1. 配送中心和卸货点展示图

5.2 实验结果及分析
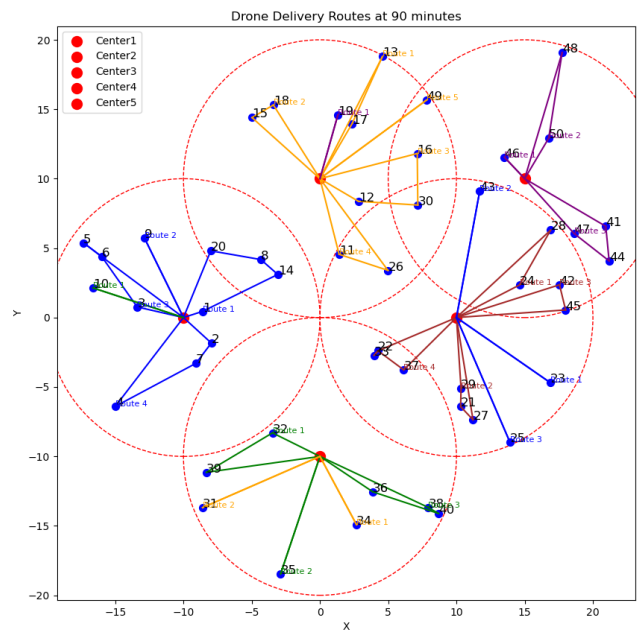
通过对一天 8 小时时间的模拟，每次决策和模拟的输出和示意图见附录 B。

部分输出展示如下：

图 2 90min 时的路径规划

图 3 程序运行输出

我们得到的实验指标如下：

总配送距离（km）	总配送订单数	无人机平均载货量（订单数）	平均路程长度（km）
12083	2497	4	16.97

总配送距离是衡量路径规划算法效率的重要指标，实验结果显示，总配送距离为 12083 公里，表明在处理大量订单的情况下，路径规划算法能够有效控制总配送路径长度。通过合理的路径规划，每架无人机在执行配送任务时，其总行驶距离被优化到一个较低的水平，确保了配送任务能够在较短的总距离内完成，从而降低了配送成本和时间。

总配送订单数为 2497 单，显示了系统在规定时间内处理的订单数量。这个数据反映了系统在高效路径规划和订单调度下的工作能力。系统能够在高效路径规划和合理订单调度的支持下，成功处理大量订单，确保每个订单都能在规定的时间内完成。这个结果说明路径规划和订单调度算法的有效性，使得系统在高负荷工作状态下依然能保持高效运行。

无人机的平均载货量为 4 单，这一指标表明，每架无人机在执行配送任务时，平均载有 4 单货物。无人机载货量的均衡分配反映了在路径规划和订单调度中的成功应用，使得无人机在执行任务时都能最大化其载货能力，避免了部分无人机过载或空载的问题，提高了整体配送效率。

平均路程长度为 16.97 公里，这个指标反映了每次配送任务的平均路径长度。路径优化算法确保了每次配送任务的路径尽可能短，从而减少了每次任务所需的时间和燃料成本。较短的平均路程长度不仅提高了配送效率，还降低了运营成本，提高了整体经济效益。

综合来看，以上数据表明，路径规划和订单调度算法在无人机配送任务中表现出色。总配送距离的合理控制、较高的订单处理能力、均衡的无人机载货量以及较短的平均路程长度都表明，算法能够在实际应用中有效提升无人机配送的整体效率和可靠性。通过不断改进和优化这些算法，可以进一步提高路径规划和订单调度的效率，适应更复杂的配送需求和场景，实现无人机配送路径规划的全局最优解，从而提升物流配送的整体效率和可靠性。

6. 总结

在本报告中，我们深入探讨了无人机配送路径规划问题，并通过实验验证了算法的有效性。无人机配送作为一种新兴的物流方式，因其高效和灵活的特点，能够有效应对传统物流模式中存在的交通拥堵和配送成本高等问题。通过合理的算法设计，我们实现了配送路径的优化，从而显著提升了配送效率和可靠性。

在实验过程中，我们设定了多个配送中心和卸货点，并根据不同的优先级生成订单。为了优化配送路径，我们应用了最近邻算法、Clarke-Wright 节约算法、贪心算法以及 2-opt 和 3-opt 算法等多种启发式和局部搜索算法。这些算法相互结合，通过不同的优化策略和步骤，实现了总配送距离的最小化，并确保了订单的及时处理。

实验结果显示，总配送距离为 12083 公里，总配送订单数为 2497 单，无人机平均载货量为 4 单，平均路程长度为 16.97 公里。数据表明，通过合理的路径规划和订单调度算法，我们能够在规定时间内高效处理大量订单，同时最大化无人机的载货能力，减少每次配送任务的平均路径长度，从而提高整体配送效率和经济效益。

此外，通过对路径的优化和距离约束的强制执行，我们确保了每条路径的总距离均在无人机的最大飞行距离范围内，避免了因飞行距离超限而导致的配送任务失败。这一策略不仅提升了配送任务的可行性和可靠性，还为实际应用提供了有效的解决方案。

综上所述，本研究通过多种优化算法的综合应用，实现了无人机配送路径规划问题的有效解决。在未来的研究中，可以进一步优化这些算法的组合策略，尝试更多的优化方法和调度策略，以应对更复杂的配送需求和场景，最终实现无人机配送路径规划的全局最优解，提升物流配送的整体效率和可靠性。

附录 A

50 个卸货点的标号和坐标

Depot coordinates:

Point 1: (-8.603229162008107, 0.4437952724431861)
Point 2: (-7.957854355051205, -1.8355337757721473)
Point 3: (-13.388741896820994, 0.762261342745229)
Point 4: (-14.993208866328548, -6.39882678357857)
Point 5: (-17.321848485556828, 5.378819655194851)
Point 6: (-15.980616885383476, 4.378944006357222)
Point 7: (-9.084872106462806, -3.2955272258501322)
Point 8: (-4.334374856510031, 4.176783153262152)
Point 9: (-12.859430000673159, 5.730567844859861)
Point 10: (-16.623647221131876, 2.131760682916189)
Point 11: (1.4019881336887576, 4.555707281743866)
Point 12: (2.8214455534636005, 8.368168548110718)
Point 13: (4.576493500984924, 18.794978298876874)
Point 14: (-3.0874420039449784, 3.103257065269789)
Point 15: (-4.976411108711487, 14.398542024450327)
Point 16: (7.128646391987735, 11.81361135932624)
Point 17: (2.355187517278623, 13.961323840754456)
Point 18: (-3.410468349373205, 15.309221104626312)
Point 19: (1.3124395412066874, 14.58976064737227)
Point 20: (-8.000439787573319, 4.805054145432696)
Point 21: (10.309088823709132, -6.415001000758974)
Point 22: (4.251948684412333, -2.3951945248785327)
Point 23: (16.872483421066875, -4.685690848817765)
Point 24: (14.613438783371764, 2.3419158318250215)
Point 25: (13.906666994715653, -8.946828300862755)
Point 26: (4.984895204905033, 3.3959810719720043)
Point 27: (11.213324755545013, -7.362020807732391)
Point 28: (16.900106432085664, 6.294432058746539)
Point 29: (10.335599967723578, -5.085646614498548)
Point 30: (7.169317643437722, 8.101733162017405)
Point 31: (-8.59943693694847, -13.685966435553567)
Point 32: (-3.4773143534716304, -8.304786340301337)
Point 33: (3.962564179569073, -2.7255427045618505)
Point 34: (2.6782775934243093, -14.913252709495854)
Point 35: (-2.8860422422043426, -18.466036891908956)
Point 36: (3.8733518119105446, -12.550741761385463)

Point 37: (6.138691644775919, -3.7672673655118434)
Point 38: (7.9293552997815375, -13.670189881433155)
Point 39: (-8.319102592254309, -11.143927687095687)
Point 40: (8.689999347575151, -14.111620174512993)
Point 41: (20.943551228279645, 6.56967141811205)
Point 42: (17.54899053934103, 2.3586948451811747)
Point 43: (11.71039696301045, 9.131668925805338)
Point 44: (21.186253214931646, 4.079581334304046)
Point 45: (18.000048504508946, 0.5475054203216185)
Point 46: (13.517163756313, 11.54373394937958)
Point 47: (18.626579275020624, 6.046675031476516)
Point 48: (17.746138074011995, 19.088628396968577)
Point 49: (7.81234452975742, 15.663807070396569)
Point 50: (16.7573201343255, 12.914649429559127)

附录 B

一天的关键数据输出：

Number of new orders generated at 0 minutes: 159
Number of orders to be processed by center 1: 49
Number of orders to be processed by center 2: 19
Number of orders to be processed by center 3: 37
Number of orders to be processed by center 4: 17
Number of orders to be processed by center 5: 18
Routes for center 1 at 0 minutes:
Route 1: Center 1 -> Point 10 -> Point 10 -> Point 10 -> Point 1 -> Point 10 -> Point 1 -> Point 1 -> Point 1 -> Point 1 -> Point 2 -> Point 2 -> Point 2 -> Center 1 with total distance: 16.19 km
Number of orders in this route: 12
Route 2: Center 1 -> Point 9 -> Point 16 -> Point 16 -> Point 16 -> Point 16 -> Point 9 -> Point 9 -> Point 16 -> Point 3 -> Point 7 -> Point 7 -> Point 7 -> Center 1 with total distance: 17.46 km
Number of orders in this route: 12
Route 3: Center 1 -> Point 5 -> Point 8 -> Point 8 -> Point 6 -> Point 6 -> Point 6 -> Point 6 -> Center 1 with total distance: 19.84 km
Number of orders in this route: 7
Route 4: Center 1 -> Point 39 -> Point 35 -> Point 35 -> Point 35 -> Center 1 with total distance: 15.24 km
Number of orders in this route: 4
Route 5: Center 1 -> Point 33 -> Point 33 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km
Number of orders in this route: 4
Route 6: Center 1 -> Point 7 -> Point 4 -> Center 1 with total distance: 13.84 km
Number of orders in this route: 2

Routes for center 1 at 0 minutes:

Route 1: Center 1 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 15 -> Point 15 -> Point 15 -> Point 15 -> Center 1 with total distance: 17.84 km

Number of orders in this route: 8

Routes for center 2 at 0 minutes:

Route 1: Center 2 -> Point 48 -> Point 48 -> Point 48 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 4

Route 2: Center 2 -> Point 13 -> Point 17 -> Center 2 with total distance: 16.82 km

Number of orders in this route: 2

Route 3: Center 2 -> Point 14 -> Point 14 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 3

Route 4: Center 2 -> Point 17 -> Point 19 -> Point 19 -> Point 11 -> Point 11 -> Center 2 with total distance: 18.99 km

Number of orders in this route: 5

Routes for center 2 at 0 minutes:

Route 1: Center 2 -> Point 18 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Center 2 with total distance: 19.75 km

Number of orders in this route: 5

Routes for center 3 at 0 minutes:

Route 1: Center 3 -> Point 30 -> Point 30 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 4

Route 2: Center 3 -> Point 43 -> Point 28 -> Point 28 -> Point 28 -> Point 24 -> Center 3 with total distance: 16.96 km

Number of orders in this route: 5

Route 3: Center 3 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Point 47 -> Point 47 -> Point 47 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.14 km

Number of orders in this route: 9

Route 4: Center 3 -> Point 44 -> Point 44 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 3

Route 5: Center 3 -> Point 22 -> Point 22 -> Point 22 -> Point 22 -> Point 22 -> Point 29 -> Point 29 -> Point 26 -> Point 25 -> Point 25 -> Point 25 -> Point 25 -> Point 25 -> Center 3 with total distance: 18.20 km

Number of orders in this route: 13

Routes for center 3 at 0 minutes:

Route 1: Center 3 -> Point 27 -> Point 21 -> Point 21 -> Center 3 with total distance: 18.77 km

Number of orders in this route: 3

Routes for center 4 at 0 minutes:

Route 1: Center 4 -> Point 40 -> Point 36 -> Point 37 -> Point 37 -> Point 37 -> Point 37 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 6

Route 2: Center 4 -> Point 34 -> Point 38 -> Point 32 -> Point 32 -> Point 32 -> Point 38 -> Center 4 with total distance: 19.23 km

Number of orders in this route: 6

Route 3: Center 4 -> Point 31 -> Point 31 -> Point 31 -> Point 31 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 5

Routes for center 5 at 0 minutes:

Route 1: Center 5 -> Point 42 -> Point 42 -> Point 42 -> Point 42 -> Point 42 -> Point 46 -> Point 46 -> Point 46 -> Point 45 -> Point 46 -> Center 5 with total distance: 14.21 km

Number of orders in this route: 10

Route 2: Center 5 -> Point 50 -> Point 50 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 3

Route 3: Center 5 -> Point 49 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 2

Route 4: Center 5 -> Point 41 -> Point 41 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 3

Number of remaining orders at 0 minutes:47

Number of new orders generated at 30 minutes: 169

Number of orders to be processed by center 1: 61

Number of orders to be processed by center 2: 18

Number of orders to be processed by center 3: 32

Number of orders to be processed by center 4: 23

Number of orders to be processed by center 5: 16

Routes for center 1 at 30 minutes:

Route 1: Center 1 -> Point 6 -> Point 6 -> Point 6 -> Point 6 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Center 1 with total distance: 17.22 km

Number of orders in this route: 13

Route 2: Center 1 -> Point 7 -> Point 7 -> Point 7 -> Point 20 -> Point 20 -> Point 15 -> Point 15 -> Center 1 with total distance: 17.90 km

Number of orders in this route: 7

Route 3: Center 1 -> Point 4 -> Point 4 -> Point 4 -> Point 4 -> Center 1 with total distance: 12.38 km

Number of orders in this route: 4

Routes for center 1 at 30 minutes:

Route 1: Center 1 -> Point 9 -> Point 9 -> Point 9 -> Point 16 -> Point 9 -> Point 9 -> Point 16 -> Point 16 -> Point 16 -> Point 16 -> Point 3 -> Point 3 -> Point 3 -> Point 3 -> Point 39 -> Point 39 -> Point 39 -> Point 39 -> Center 1 with total distance: 18.70 km

Number of orders in this route: 18

Route 2: Center 1 -> Point 33 -> Point 33 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 4

Route 3: Center 1 -> Point 5 -> Center 1 with total distance: 19.41 km

Number of orders in this route: 1

Route 4: Center 1 -> Point 10 -> Point 10 -> Point 1 -> Point 10 -> Point 1 -> Point 1 -> Point 10

-> Point 1 -> Point 1 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Center 1 with total distance: 16.99 km

Number of orders in this route: 14

Routes for center 2 at 30 minutes:

Route 1: Center 2 -> Point 17 -> Point 17 -> Point 17 -> Point 17 -> Point 19 -> Point 19 -> Point 11 -> Center 2 with total distance: 18.99 km

Number of orders in this route: 7

Route 2: Center 2 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 1

Route 3: Center 2 -> Point 18 -> Point 18 -> Point 18 -> Point 12 -> Point 12 -> Point 13 -> Point 13 -> Center 2 with total distance: 19.86 km

Number of orders in this route: 7

Route 4: Center 2 -> Point 48 -> Point 48 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 3

Routes for center 3 at 30 minutes:

Route 1: Center 3 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 1

Route 2: Center 3 -> Point 27 -> Point 27 -> Point 27 -> Point 23 -> Center 3 with total distance: 17.49 km

Number of orders in this route: 4

Route 3: Center 3 -> Point 24 -> Point 24 -> Point 24 -> Point 24 -> Point 24 -> Point 28 -> Point 28 -> Point 28 -> Point 43 -> Point 43 -> Center 3 with total distance: 16.96 km

Number of orders in this route: 10

Route 4: Center 3 -> Point 44 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 2

Route 5: Center 3 -> Point 22 -> Point 22 -> Point 29 -> Point 29 -> Point 26 -> Point 26 -> Point 26 -> Point 25 -> Point 25 -> Point 25 -> Point 25 -> Center 3 with total distance: 18.20 km

Number of orders in this route: 11

Routes for center 3 at 30 minutes:

Route 1: Center 3 -> Point 21 -> Point 21 -> Point 21 -> Center 3 with total distance: 17.90 km

Number of orders in this route: 3

Routes for center 3 at 30 minutes:

Route 1: Center 3 -> Point 47 -> Center 3 with total distance: 19.03 km

Number of orders in this route: 1

Routes for center 4 at 30 minutes:

Route 1: Center 4 -> Point 40 -> Point 40 -> Point 36 -> Point 36 -> Point 36 -> Point 36 -> Point 37 -> Point 37 -> Point 37 -> Point 37 -> Point 37 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 11

Route 2: Center 4 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 1

Route 3: Center 4 -> Point 34 -> Point 34 -> Point 34 -> Point 34 -> Point 38 -> Point 32 -> Point 38 -> Center 4 with total distance: 19.23 km

Number of orders in this route: 7

Routes for center 5 at 30 minutes:

Route 1: Center 5 -> Point 50 -> Point 50 -> Point 50 -> Point 50 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 5

Route 2: Center 5 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 1

Routes for center 5 at 30 minutes:

Route 1: Center 5 -> Point 42 -> Point 46 -> Point 45 -> Point 46 -> Point 46 -> Point 45 -> Point 46 -> Point 45 -> Center 5 with total distance: 16.99 km

Number of orders in this route: 8

Route 2: Center 5 -> Point 49 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 2

Number of remaining orders at 30 minutes:47

Number of new orders generated at 60 minutes: 165

Number of orders to be processed by center 1: 54

Number of orders to be processed by center 2: 23

Number of orders to be processed by center 3: 38

Number of orders to be processed by center 4: 18

Number of orders to be processed by center 5: 13

Routes for center 1 at 60 minutes:

Route 1: Center 1 -> Point 6 -> Point 6 -> Point 6 -> Point 6 -> Point 6 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 8 -> Point 8 -> Point 8 -> Center 1 with total distance: 17.22 km

Number of orders in this route: 13

Route 2: Center 1 -> Point 7 -> Point 7 -> Point 7 -> Point 7 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 15 -> Point 15 -> Center 1 with total distance: 17.90 km

Number of orders in this route: 10

Route 3: Center 1 -> Point 4 -> Point 4 -> Point 4 -> Point 4 -> Center 1 with total distance: 12.38 km

Number of orders in this route: 4

Routes for center 1 at 60 minutes:

Route 1: Center 1 -> Point 9 -> Point 16 -> Point 16 -> Point 3 -> Point 3 -> Point 3 -> Point 39 -> Point 39 -> Point 39 -> Point 39 -> Point 39 -> Center 1 with total distance: 17.96 km

Number of orders in this route: 11

Route 2: Center 1 -> Point 33 -> Point 33 -> Point 33 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 5

Route 3: Center 1 -> Point 5 -> Point 5 -> Point 5 -> Center 1 with total distance: 19.41 km

Number of orders in this route: 3

Route 4: Center 1 -> Point 10 -> Point 1 -> Point 1 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Center 1 with total distance: 15.39 km

Number of orders in this route: 8

Routes for center 2 at 60 minutes:

Route 1: Center 2 -> Point 48 -> Point 48 -> Point 48 -> Point 48 -> Point 48 -> Center 2 with

total distance: 18.23 km

Number of orders in this route: 5

Route 2: Center 2 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 1

Route 3: Center 2 -> Point 13 -> Point 13 -> Point 13 -> Point 12 -> Point 12 -> Point 12 -> Point 18 -> Point 18 -> Point 18 -> Center 2 with total distance: 19.86 km

Number of orders in this route: 9

Route 4: Center 2 -> Point 19 -> Point 19 -> Point 19 -> Point 19 -> Point 17 -> Point 17 -> Point 11 -> Point 11 -> Center 2 with total distance: 18.89 km

Number of orders in this route: 8

Routes for center 3 at 60 minutes:

Route 1: Center 3 -> Point 24 -> Point 24 -> Point 24 -> Point 28 -> Point 28 -> Point 28 -> Point 28 -> Point 43 -> Point 43 -> Point 43 -> Point 43 -> Point 43 -> Center 3 with total distance: 16.96 km

Number of orders in this route: 12

Route 2: Center 3 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 1

Route 3: Center 3 -> Point 30 -> Point 30 -> Point 30 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 5

Route 4: Center 3 -> Point 27 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Center 3 with total distance: 17.49 km

Number of orders in this route: 5

Route 5: Center 3 -> Point 22 -> Point 29 -> Point 29 -> Point 29 -> Point 26 -> Point 26 -> Point 26 -> Point 26 -> Point 25 -> Point 25 -> Center 3 with total distance: 18.20 km

Number of orders in this route: 10

Routes for center 3 at 60 minutes:

Route 1: Center 3 -> Point 21 -> Point 21 -> Center 3 with total distance: 17.90 km

Number of orders in this route: 2

Routes for center 3 at 60 minutes:

Route 1: Center 3 -> Point 47 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.03 km

Number of orders in this route: 3

Routes for center 4 at 60 minutes:

Route 1: Center 4 -> Point 40 -> Point 40 -> Point 40 -> Point 40 -> Point 36 -> Point 36 -> Point 37 -> Point 37 -> Point 37 -> Point 37 -> Point 37 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 11

Route 2: Center 4 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 1

Route 3: Center 4 -> Point 34 -> Point 34 -> Point 38 -> Point 32 -> Point 38 -> Point 38 -> Center 4 with total distance: 19.23 km

Number of orders in this route: 6

Routes for center 5 at 60 minutes:

Route 1: Center 5 -> Point 42 -> Point 42 -> Point 42 -> Point 42 -> Point 46 -> Point 45 -> Center 5 with total distance: 14.13 km

Number of orders in this route: 6

Route 2: Center 5 -> Point 50 -> Point 50 -> Point 50 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 4

Route 3: Center 5 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 1

Route 4: Center 5 -> Point 41 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 2

Number of remaining orders at 60 minutes:47

Number of new orders generated at 90 minutes: 173

Number of orders to be processed by center 1: 46

Number of orders to be processed by center 2: 27

Number of orders to be processed by center 3: 41

Number of orders to be processed by center 4: 24

Number of orders to be processed by center 5: 16

Routes for center 1 at 90 minutes:

Route 1: Center 1 -> Point 7 -> Point 7 -> Point 7 -> Point 3 -> Point 16 -> Point 9 -> Point 9 -> Point 16 -> Point 16 -> Point 16 -> Point 16 -> Point 9 -> Center 1 with total distance: 17.46 km

Number of orders in this route: 12

Route 2: Center 1 -> Point 39 -> Point 39 -> Point 39 -> Point 39 -> Point 39 -> Point 35 -> Point 35 -> Point 35 -> Point 6 -> Center 1 with total distance: 15.59 km

Number of orders in this route: 9

Route 3: Center 1 -> Point 4 -> Point 4 -> Point 4 -> Center 1 with total distance: 12.38 km

Number of orders in this route: 3

Route 4: Center 1 -> Point 8 -> Point 8 -> Point 5 -> Center 1 with total distance: 19.83 km

Number of orders in this route: 3

Route 5: Center 1 -> Point 33 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 3

Route 6: Center 1 -> Point 10 -> Point 10 -> Point 10 -> Point 1 -> Point 10 -> Point 10 -> Point 1 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Center 1 with total distance: 16.19 km

Number of orders in this route: 12

Routes for center 1 at 90 minutes:

Route 1: Center 1 -> Point 20 -> Point 20 -> Point 15 -> Point 15 -> Center 1 with total distance: 17.84 km

Number of orders in this route: 4

Routes for center 2 at 90 minutes:

Route 1: Center 2 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 4

Route 2: Center 2 -> Point 11 -> Point 11 -> Point 19 -> Point 19 -> Point 19 -> Point 17 -> Point 17 -> Point 17 -> Point 17 -> Center 2 with total distance: 18.99 km

Number of orders in this route: 9

Route 3: Center 2 -> Point 13 -> Point 13 -> Point 13 -> Point 13 -> Point 12 -> Point 12 -> Point

12 -> Point 18 -> Point 18 -> Point 18 -> Point 18 -> Center 2 with total distance: 19.86 km

Number of orders in this route: 11

Route 4: Center 2 -> Point 48 -> Point 48 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 3

Routes for center 3 at 90 minutes:

Route 1: Center 3 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 2

Route 2: Center 3 -> Point 24 -> Point 28 -> Point 28 -> Point 28 -> Point 28 -> Point 24 -> Point 24 -> Point 24 -> Point 43 -> Point 43 -> Point 43 -> Point 43 -> Point 43 -> Center 3 with total distance: 17.79 km

Number of orders in this route: 13

Route 3: Center 3 -> Point 23 -> Point 23 -> Point 23 -> Point 47 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.14 km

Number of orders in this route: 6

Route 4: Center 3 -> Point 44 -> Point 44 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 3

Route 5: Center 3 -> Point 22 -> Point 29 -> Point 29 -> Point 29 -> Point 26 -> Point 25 -> Point 25 -> Point 25 -> Point 25 -> Center 3 with total distance: 18.20 km

Number of orders in this route: 9

Routes for center 3 at 90 minutes:

Route 1: Center 3 -> Point 27 -> Point 27 -> Point 27 -> Point 21 -> Point 21 -> Point 21 -> Point 21 -> Point 21 -> Center 3 with total distance: 18.77 km

Number of orders in this route: 8

Routes for center 4 at 90 minutes:

Route 1: Center 4 -> Point 37 -> Point 37 -> Point 37 -> Point 37 -> Point 36 -> Point 36 -> Point 36 -> Point 36 -> Point 36 -> Point 40 -> Point 40 -> Point 40 -> Point 40 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 13

Route 2: Center 4 -> Point 34 -> Point 34 -> Point 34 -> Point 34 -> Point 38 -> Point 32 -> Point 32 -> Center 4 with total distance: 19.21 km

Number of orders in this route: 7

Route 3: Center 4 -> Point 31 -> Point 31 -> Point 31 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 4

Routes for center 5 at 90 minutes:

Route 1: Center 5 -> Point 50 -> Point 50 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 3

Route 2: Center 5 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 1

Routes for center 5 at 90 minutes:

Route 1: Center 5 -> Point 42 -> Point 42 -> Point 42 -> Point 42 -> Point 45 -> Point 45 -> Point 45 -> Point 46 -> Center 5 with total distance: 14.00 km

Number of orders in this route: 8

Route 2: Center 5 -> Point 49 -> Point 49 -> Point 49 -> Point 49 -> Center 5 with total distance:

17.95 km

Number of orders in this route: 4

Number of remaining orders at 90 minutes:47

Number of new orders generated at 120 minutes: 181

Number of orders to be processed by center 1: 58

Number of orders to be processed by center 2: 20

Number of orders to be processed by center 3: 43

Number of orders to be processed by center 4: 22

Number of orders to be processed by center 5: 19

Routes for center 1 at 120 minutes:

Route 1: Center 1 -> Point 39 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Center 1 with total distance: 15.24 km

Number of orders in this route: 6

Route 2: Center 1 -> Point 10 -> Point 10 -> Point 10 -> Point 1 -> Point 1 -> Point 10 -> Point 10 -> Point 1 -> Point 1 -> Point 1 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Center 1 with total distance: 16.19 km

Number of orders in this route: 14

Route 3: Center 1 -> Point 7 -> Point 7 -> Point 7 -> Point 3 -> Point 3 -> Point 3 -> Point 16 -> Point 9 -> Point 9 -> Point 9 -> Point 16 -> Point 9 -> Center 1 with total distance: 17.46 km

Number of orders in this route: 12

Route 4: Center 1 -> Point 33 -> Point 33 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 4

Route 5: Center 1 -> Point 6 -> Point 6 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Point 5 -> Point 5 -> Point 5 -> Point 5 -> Point 5 -> Center 1 with total distance: 19.84 km

Number of orders in this route: 12

Route 6: Center 1 -> Point 7 -> Point 4 -> Point 4 -> Point 4 -> Center 1 with total distance: 13.84 km

Number of orders in this route: 4

Routes for center 1 at 120 minutes:

Route 1: Center 1 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 15 -> Center 1 with total distance: 17.84 km

Number of orders in this route: 6

Routes for center 2 at 120 minutes:

Route 1: Center 2 -> Point 17 -> Point 17 -> Point 17 -> Point 17 -> Point 18 -> Point 18 -> Point 19 -> Center 2 with total distance: 16.71 km

Number of orders in this route: 7

Route 2: Center 2 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 1

Route 3: Center 2 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 4

Route 4: Center 2 -> Point 13 -> Point 12 -> Point 13 -> Point 13 -> Center 2 with total distance:

19.96 km

Number of orders in this route: 4

Route 5: Center 2 -> Point 11 -> Point 11 -> Point 11 -> Point 11 -> Center 2 with total distance: 6.74 km

Number of orders in this route: 4

Routes for center 3 at 120 minutes:

Route 1: Center 3 -> Point 27 -> Point 27 -> Point 27 -> Point 27 -> Point 27 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Point 21 -> Point 21 -> Point 21 -> Point 21 -> Point 21 -> Center 3 with total distance: 19.57 km

Number of orders in this route: 15

Route 2: Center 3 -> Point 26 -> Point 25 -> Center 3 with total distance: 16.52 km

Number of orders in this route: 2

Route 3: Center 3 -> Point 24 -> Point 28 -> Point 28 -> Point 28 -> Point 43 -> Point 43 -> Point 43 -> Point 22 -> Point 22 -> Point 22 -> Point 29 -> Point 29 -> Point 29 -> Point 29 -> Center 3 with total distance: 19.31 km

Number of orders in this route: 14

Routes for center 3 at 120 minutes:

Route 1: Center 3 -> Point 30 -> Point 30 -> Point 30 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 5

Route 2: Center 3 -> Point 47 -> Point 47 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.03 km

Number of orders in this route: 4

Route 3: Center 3 -> Point 44 -> Point 44 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 3

Routes for center 4 at 120 minutes:

Route 1: Center 4 -> Point 37 -> Point 37 -> Point 37 -> Point 37 -> Point 36 -> Point 36 -> Point 36 -> Point 36 -> Point 36 -> Point 40 -> Point 40 -> Point 40 -> Point 40 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 13

Route 2: Center 4 -> Point 34 -> Point 38 -> Point 32 -> Point 32 -> Point 32 -> Point 32 -> Point 32 -> Center 4 with total distance: 19.21 km

Number of orders in this route: 7

Route 3: Center 4 -> Point 31 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 2

Routes for center 5 at 120 minutes:

Route 1: Center 5 -> Point 42 -> Point 45 -> Point 45 -> Point 45 -> Point 46 -> Point 46 -> Point 45 -> Center 5 with total distance: 15.35 km

Number of orders in this route: 7

Route 2: Center 5 -> Point 50 -> Point 50 -> Point 50 -> Point 50 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 5

Route 3: Center 5 -> Point 49 -> Point 49 -> Point 49 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 4

Route 4: Center 5 -> Point 41 -> Point 41 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 3

Number of remaining orders at 120 minutes:47

Number of new orders generated at 150 minutes: 180

Number of orders to be processed by center 1: 49

Number of orders to be processed by center 2: 24

Number of orders to be processed by center 3: 46

Number of orders to be processed by center 4: 28

Number of orders to be processed by center 5: 14

Routes for center 1 at 150 minutes:

Route 1: Center 1 -> Point 4 -> Point 4 -> Point 4 -> Point 4 -> Point 4 -> Center 1 with total distance: 12.38 km

Number of orders in this route: 5

Route 2: Center 1 -> Point 6 -> Point 6 -> Point 6 -> Point 6 -> Point 5 -> Point 5 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Center 1 with total distance: 19.86 km

Number of orders in this route: 11

Route 3: Center 1 -> Point 10 -> Point 10 -> Point 10 -> Point 1 -> Point 10 -> Point 10 -> Point 1 -> Point 1 -> Point 2 -> Point 2 -> Point 2 -> Center 1 with total distance: 16.19 km

Number of orders in this route: 11

Route 4: Center 1 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 1

Route 5: Center 1 -> Point 3 -> Point 3 -> Point 39 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 39 -> Point 39 -> Point 39 -> Center 1 with total distance: 16.64 km

Number of orders in this route: 10

Route 6: Center 1 -> Point 20 -> Point 20 -> Point 20 -> Point 15 -> Point 7 -> Center 1 with total distance: 17.84 km

Number of orders in this route: 5

Routes for center 1 at 150 minutes:

Route 1: Center 1 -> Point 16 -> Point 16 -> Point 9 -> Point 16 -> Point 9 -> Point 9 -> Center 1 with total distance: 16.31 km

Number of orders in this route: 6

Routes for center 2 at 150 minutes:

Route 1: Center 2 -> Point 14 -> Point 14 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 3

Route 2: Center 2 -> Point 13 -> Point 13 -> Point 13 -> Point 13 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Point 18 -> Point 18 -> Point 18 -> Point 18 -> Center 2 with total distance: 19.86 km

Number of orders in this route: 12

Route 3: Center 2 -> Point 17 -> Point 17 -> Point 17 -> Point 19 -> Point 11 -> Center 2 with total distance: 18.99 km

Number of orders in this route: 5

Route 4: Center 2 -> Point 48 -> Point 48 -> Point 48 -> Point 48 -> Center 2 with total distance:

18.23 km

Number of orders in this route: 4

Routes for center 3 at 150 minutes:

Route 1: Center 3 -> Point 30 -> Point 30 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 4

Route 2: Center 3 -> Point 27 -> Point 27 -> Point 27 -> Point 27 -> Point 27 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Center 3 with total distance: 17.49 km

Number of orders in this route: 10

Route 3: Center 3 -> Point 43 -> Point 28 -> Point 28 -> Point 28 -> Point 28 -> Point 28 -> Point 24 -> Point 24 -> Point 43 -> Point 43 -> Point 43 -> Point 43 -> Center 3 with total distance: 17.32 km

Number of orders in this route: 12

Route 4: Center 3 -> Point 44 -> Point 44 -> Point 44 -> Point 44 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 5

Route 5: Center 3 -> Point 22 -> Point 29 -> Point 26 -> Point 26 -> Point 26 -> Point 25 -> Point 25 -> Point 25 -> Point 25 -> Center 3 with total distance: 18.20 km

Number of orders in this route: 9

Routes for center 3 at 150 minutes:

Route 1: Center 3 -> Point 21 -> Center 3 with total distance: 17.90 km

Number of orders in this route: 1

Routes for center 3 at 150 minutes:

Route 1: Center 3 -> Point 47 -> Point 47 -> Point 47 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.03 km

Number of orders in this route: 5

Routes for center 4 at 150 minutes:

Route 1: Center 4 -> Point 37 -> Point 37 -> Point 37 -> Point 37 -> Point 36 -> Point 36 -> Point 36 -> Point 36 -> Point 40 -> Point 40 -> Point 40 -> Point 40 -> Point 40 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 13

Route 2: Center 4 -> Point 38 -> Point 32 -> Point 32 -> Point 32 -> Point 38 -> Point 38 -> Point 38 -> Point 38 -> Center 4 with total distance: 19.21 km

Number of orders in this route: 8

Route 3: Center 4 -> Point 34 -> Point 34 -> Center 4 with total distance: 7.05 km

Number of orders in this route: 2

Routes for center 4 at 150 minutes:

Route 1: Center 4 -> Point 31 -> Point 31 -> Point 31 -> Point 31 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 5

Routes for center 5 at 150 minutes:

Route 1: Center 5 -> Point 42 -> Point 46 -> Point 45 -> Point 45 -> Point 45 -> Point 45 -> Center 5 with total distance: 14.13 km

Number of orders in this route: 6

Route 2: Center 5 -> Point 50 -> Point 50 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 3

Route 3: Center 5 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 1

Route 4: Center 5 -> Point 41 -> Point 41 -> Point 41 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 4

Number of remaining orders at 150 minutes:47

Number of new orders generated at 180 minutes: 195

Number of orders to be processed by center 1: 64

Number of orders to be processed by center 2: 18

Number of orders to be processed by center 3: 51

Number of orders to be processed by center 4: 24

Number of orders to be processed by center 5: 19

Routes for center 1 at 180 minutes:

Route 1: Center 1 -> Point 4 -> Point 4 -> Point 4 -> Point 4 -> Point 4 -> Center 1 with total distance: 12.38 km

Number of orders in this route: 5

Route 2: Center 1 -> Point 6 -> Point 6 -> Point 6 -> Point 6 -> Point 35 -> Point 35 -> Point 35 -> Point 39 -> Center 1 with total distance: 15.59 km

Number of orders in this route: 8

Route 3: Center 1 -> Point 7 -> Point 7 -> Point 7 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 15 -> Point 15 -> Point 15 -> Point 15 -> Point 15 -> Center 1 with total distance: 17.90 km

Number of orders in this route: 13

Route 4: Center 1 -> Point 5 -> Point 5 -> Point 5 -> Point 5 -> Point 5 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Center 1 with total distance: 19.83 km

Number of orders in this route: 9

Route 5: Center 1 -> Point 33 -> Point 33 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 4

Route 6: Center 1 -> Point 10 -> Point 10 -> Point 1 -> Point 1 -> Point 1 -> Point 1 -> Point 10 -> Point 10 -> Point 1 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Center 1 with total distance: 16.19 km

Number of orders in this route: 14

Routes for center 1 at 180 minutes:

Route 1: Center 1 -> Point 3 -> Point 3 -> Point 3 -> Point 3 -> Point 3 -> Point 16 -> Point 9 -> Point 9 -> Point 16 -> Point 9 -> Point 9 -> Center 1 with total distance: 16.73 km

Number of orders in this route: 11

Routes for center 2 at 180 minutes:

Route 1: Center 2 -> Point 48 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 2

Route 2: Center 2 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 1

Route 3: Center 2 -> Point 13 -> Point 13 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Point 18 -> Center 2 with total distance: 19.86 km

Number of orders in this route: 8

Route 4: Center 2 -> Point 19 -> Point 19 -> Point 17 -> Point 17 -> Point 17 -> Point 11 -> Point 11 -> Center 2 with total distance: 18.89 km

Number of orders in this route: 7

Routes for center 3 at 180 minutes:

Route 1: Center 3 -> Point 44 -> Point 44 -> Point 44 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 4

Route 2: Center 3 -> Point 43 -> Point 28 -> Point 28 -> Point 28 -> Point 24 -> Point 24 -> Point 24 -> Point 24 -> Point 24 -> Point 43 -> Point 43 -> Point 43 -> Point 43 -> Center 3 with total distance: 17.32 km

Number of orders in this route: 13

Route 3: Center 3 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 2

Route 4: Center 3 -> Point 27 -> Point 21 -> Point 21 -> Point 21 -> Point 21 -> Center 3 with total distance: 18.77 km

Number of orders in this route: 5

Route 5: Center 3 -> Point 22 -> Point 22 -> Point 22 -> Point 22 -> Point 29 -> Point 29 -> Point 29 -> Point 29 -> Point 26 -> Point 26 -> Point 26 -> Point 26 -> Point 25 -> Center 3 with total distance: 18.20 km

Number of orders in this route: 13

Routes for center 3 at 180 minutes:

Route 1: Center 3 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Point 47 -> Point 47 -> Point 47 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.14 km

Number of orders in this route: 10

Routes for center 4 at 180 minutes:

Route 1: Center 4 -> Point 37 -> Point 37 -> Point 37 -> Point 36 -> Point 36 -> Point 36 -> Point 36 -> Point 36 -> Point 40 -> Point 40 -> Point 40 -> Point 40 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 12

Route 2: Center 4 -> Point 38 -> Point 32 -> Point 38 -> Point 38 -> Point 38 -> Point 38 -> Center 4 with total distance: 19.21 km

Number of orders in this route: 6

Route 3: Center 4 -> Point 34 -> Point 34 -> Point 34 -> Point 34 -> Center 4 with total distance: 7.05 km

Number of orders in this route: 4

Routes for center 4 at 180 minutes:

Route 1: Center 4 -> Point 31 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 2

Routes for center 5 at 180 minutes:

Route 1: Center 5 -> Point 50 -> Point 50 -> Point 50 -> Point 50 -> Point 50 -> Center 5 with

total distance: 19.80 km

Number of orders in this route: 5

Route 2: Center 5 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 1

Routes for center 5 at 180 minutes:

Route 1: Center 5 -> Point 42 -> Point 42 -> Point 42 -> Point 42 -> Point 45 -> Point 46 -> Point 45 -> Point 45 -> Point 45 -> Center 5 with total distance: 15.35 km

Number of orders in this route: 9

Route 2: Center 5 -> Point 49 -> Point 49 -> Point 49 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 4

Number of remaining orders at 180 minutes:47

Number of new orders generated at 210 minutes: 180

Number of orders to be processed by center 1: 54

Number of orders to be processed by center 2: 25

Number of orders to be processed by center 3: 43

Number of orders to be processed by center 4: 21

Number of orders to be processed by center 5: 18

Routes for center 1 at 210 minutes:

Route 1: Center 1 -> Point 6 -> Point 6 -> Point 6 -> Point 6 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Center 1 with total distance: 17.22 km

Number of orders in this route: 14

Route 2: Center 1 -> Point 7 -> Point 7 -> Point 7 -> Point 7 -> Point 7 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 15 -> Point 15 -> Point 15 -> Point 15 -> Center 1 with total distance: 17.90 km

Number of orders in this route: 13

Route 3: Center 1 -> Point 4 -> Point 4 -> Center 1 with total distance: 12.38 km

Number of orders in this route: 2

Routes for center 1 at 210 minutes:

Route 1: Center 1 -> Point 9 -> Point 9 -> Point 16 -> Point 16 -> Point 9 -> Point 16 -> Point 16 -> Point 16 -> Point 3 -> Point 39 -> Point 39 -> Point 39 -> Point 39 -> Point 39 -> Center 1 with total distance: 18.70 km

Number of orders in this route: 14

Route 2: Center 1 -> Point 5 -> Point 5 -> Center 1 with total distance: 19.41 km

Number of orders in this route: 2

Route 3: Center 1 -> Point 33 -> Point 33 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 4

Route 4: Center 1 -> Point 2 -> Point 2 -> Point 1 -> Point 1 -> Point 10 -> Center 1 with total distance: 15.39 km

Number of orders in this route: 5

Routes for center 2 at 210 minutes:

Route 1: Center 2 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 4

Route 2: Center 2 -> Point 13 -> Point 13 -> Point 13 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Point 18 -> Point 18 -> Point 18 -> Point 18 -> Point 18 -> Center 2 with total distance: 19.86 km

Number of orders in this route: 13

Route 3: Center 2 -> Point 48 -> Point 48 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 3

Route 4: Center 2 -> Point 17 -> Point 19 -> Point 19 -> Point 11 -> Point 11 -> Center 2 with total distance: 18.99 km

Number of orders in this route: 5

Routes for center 3 at 210 minutes:

Route 1: Center 3 -> Point 30 -> Point 30 -> Point 30 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 5

Route 2: Center 3 -> Point 44 -> Point 44 -> Point 44 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 4

Route 3: Center 3 -> Point 27 -> Point 27 -> Point 27 -> Point 27 -> Point 27 -> Point 23 -> Point 23 -> Point 23 -> Center 3 with total distance: 17.49 km

Number of orders in this route: 8

Route 4: Center 3 -> Point 43 -> Point 43 -> Point 28 -> Point 28 -> Point 28 -> Point 24 -> Center 3 with total distance: 16.96 km

Number of orders in this route: 6

Route 5: Center 3 -> Point 22 -> Point 22 -> Point 22 -> Point 22 -> Point 22 -> Point 29 -> Point 29 -> Point 29 -> Point 29 -> Point 26 -> Point 26 -> Point 26 -> Point 25 -> Point 25 -> Point 25 -> Point 25 -> Center 3 with total distance: 18.20 km

Number of orders in this route: 16

Routes for center 3 at 210 minutes:

Route 1: Center 3 -> Point 21 -> Center 3 with total distance: 17.90 km

Number of orders in this route: 1

Routes for center 3 at 210 minutes:

Route 1: Center 3 -> Point 47 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.03 km

Number of orders in this route: 3

Routes for center 4 at 210 minutes:

Route 1: Center 4 -> Point 34 -> Point 34 -> Point 34 -> Point 38 -> Point 32 -> Point 38 -> Point 38 -> Point 38 -> Point 38 -> Center 4 with total distance: 19.23 km

Number of orders in this route: 9

Route 2: Center 4 -> Point 40 -> Point 40 -> Point 40 -> Point 40 -> Point 36 -> Point 36 -> Point 36 -> Point 36 -> Point 36 -> Point 37 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 10

Route 3: Center 4 -> Point 31 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 2

Routes for center 5 at 210 minutes:

Route 1: Center 5 -> Point 42 -> Point 42 -> Point 42 -> Point 42 -> Point 46 -> Point 45 -> Point 46 -> Point 46 -> Point 45 -> Point 45 -> Point 45 -> Center 5 with total distance: 15.56 km

Number of orders in this route: 11

Route 2: Center 5 -> Point 50 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 2

Route 3: Center 5 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 1

Route 4: Center 5 -> Point 41 -> Point 41 -> Point 41 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 4

Number of remaining orders at 210 minutes:47

Number of new orders generated at 240 minutes: 185

Number of orders to be processed by center 1: 50

Number of orders to be processed by center 2: 26

Number of orders to be processed by center 3: 47

Number of orders to be processed by center 4: 18

Number of orders to be processed by center 5: 25

Routes for center 1 at 240 minutes:

Route 1: Center 1 -> Point 4 -> Point 4 -> Point 4 -> Point 4 -> Point 4 -> Center 1 with total distance: 12.38 km

Number of orders in this route: 5

Route 2: Center 1 -> Point 6 -> Point 6 -> Point 6 -> Point 6 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 39 -> Center 1 with total distance: 15.59 km

Number of orders in this route: 10

Route 3: Center 1 -> Point 7 -> Point 7 -> Point 7 -> Point 7 -> Point 7 -> Point 20 -> Point 20 -> Point 20 -> Point 15 -> Point 15 -> Point 15 -> Center 1 with total distance: 17.90 km

Number of orders in this route: 11

Route 4: Center 1 -> Point 5 -> Point 5 -> Point 5 -> Point 5 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Center 1 with total distance: 19.83 km

Number of orders in this route: 8

Route 5: Center 1 -> Point 33 -> Point 33 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 4

Route 6: Center 1 -> Point 10 -> Point 1 -> Point 2 -> Point 2 -> Center 1 with total distance: 15.39 km

Number of orders in this route: 4

Routes for center 1 at 240 minutes:

Route 1: Center 1 -> Point 3 -> Point 3 -> Point 16 -> Point 16 -> Point 9 -> Point 9 -> Point 9 -> Point 9 -> Center 1 with total distance: 15.99 km

Number of orders in this route: 8

Routes for center 2 at 240 minutes:

Route 1: Center 2 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 1

Route 2: Center 2 -> Point 17 -> Point 17 -> Point 17 -> Point 17 -> Point 17 -> Point 19 -> Point 19 -> Point 19 -> Point 11 -> Center 2 with total distance: 18.99 km

Number of orders in this route: 9

Route 3: Center 2 -> Point 18 -> Point 18 -> Point 18 -> Point 18 -> Point 18 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Point 13 -> Center 2 with total distance: 19.86 km

Number of orders in this route: 11

Route 4: Center 2 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 5

Routes for center 3 at 240 minutes:

Route 1: Center 3 -> Point 25 -> Point 25 -> Point 25 -> Point 25 -> Point 25 -> Point 26 -> Point 26 -> Point 26 -> Point 26 -> Point 26 -> Point 29 -> Point 29 -> Point 29 -> Center 3 with total distance: 17.39 km

Number of orders in this route: 13

Route 2: Center 3 -> Point 27 -> Point 27 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Center 3 with total distance: 17.49 km

Number of orders in this route: 7

Route 3: Center 3 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 1

Route 4: Center 3 -> Point 44 -> Point 44 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 3

Route 5: Center 3 -> Point 22 -> Point 22 -> Point 22 -> Point 22 -> Point 28 -> Point 28 -> Point 28 -> Point 28 -> Point 28 -> Point 24 -> Point 24 -> Point 24 -> Point 24 -> Point 24 -> Point 43 -> Point 43 -> Point 43 -> Point 43 -> Point 43 -> Center 3 with total distance: 18.07 km

Number of orders in this route: 19

Routes for center 3 at 240 minutes:

Route 1: Center 3 -> Point 21 -> Point 21 -> Center 3 with total distance: 17.90 km

Number of orders in this route: 2

Routes for center 3 at 240 minutes:

Route 1: Center 3 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.03 km

Number of orders in this route: 2

Routes for center 4 at 240 minutes:

Route 1: Center 4 -> Point 40 -> Point 36 -> Point 36 -> Point 37 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 4

Route 2: Center 4 -> Point 34 -> Point 34 -> Point 34 -> Point 38 -> Point 32 -> Point 38 -> Center 4 with total distance: 19.23 km

Number of orders in this route: 6

Route 3: Center 4 -> Point 31 -> Point 31 -> Point 31 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 4

Routes for center 5 at 240 minutes:

Route 1: Center 5 -> Point 42 -> Point 42 -> Point 42 -> Point 42 -> Point 42 -> Point 46 -> Point

46 -> Point 45 -> Point 45 -> Point 45 -> Point 45 -> Point 46 -> Point 45 -> Center 5 with total distance: 15.56 km

Number of orders in this route: 13

Route 2: Center 5 -> Point 50 -> Point 50 -> Point 50 -> Point 50 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 5

Route 3: Center 5 -> Point 49 -> Point 49 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 3

Route 4: Center 5 -> Point 41 -> Point 41 -> Point 41 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 4

Number of remaining orders at 240 minutes:47

Number of new orders generated at 270 minutes: 181

Number of orders to be processed by center 1: 65

Number of orders to be processed by center 2: 21

Number of orders to be processed by center 3: 38

Number of orders to be processed by center 4: 17

Number of orders to be processed by center 5: 21

Routes for center 1 at 270 minutes:

Route 1: Center 1 -> Point 6 -> Point 6 -> Point 6 -> Point 6 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Center 1 with total distance: 17.22 km

Number of orders in this route: 13

Route 2: Center 1 -> Point 7 -> Point 7 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 15 -> Point 15 -> Point 15 -> Point 15 -> Point 15 -> Center 1 with total distance: 17.90 km

Number of orders in this route: 11

Route 3: Center 1 -> Point 4 -> Point 4 -> Point 4 -> Center 1 with total distance: 12.38 km

Number of orders in this route: 3

Routes for center 1 at 270 minutes:

Route 1: Center 1 -> Point 9 -> Point 16 -> Point 9 -> Point 9 -> Point 9 -> Point 9 -> Point 16 -> Point 16 -> Point 16 -> Point 16 -> Point 3 -> Point 3 -> Point 3 -> Point 39 -> Point 39 -> Center 1 with total distance: 18.70 km

Number of orders in this route: 15

Route 2: Center 1 -> Point 33 -> Point 33 -> Point 33 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 5

Route 3: Center 1 -> Point 5 -> Point 5 -> Point 5 -> Center 1 with total distance: 19.41 km

Number of orders in this route: 3

Route 4: Center 1 -> Point 10 -> Point 10 -> Point 10 -> Point 10 -> Point 1 -> Point 1 -> Point 1 -> Point 1 -> Point 10 -> Point 1 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Center 1 with total distance: 16.19 km

Number of orders in this route: 15

Routes for center 2 at 270 minutes:

Route 1: Center 2 -> Point 17 -> Point 19 -> Point 19 -> Point 11 -> Center 2 with total distance: 18.99 km

Number of orders in this route: 4

Route 2: Center 2 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 1

Route 3: Center 2 -> Point 18 -> Point 18 -> Point 18 -> Point 18 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Point 13 -> Point 13 -> Point 13 -> Point 13 -> Point 13 -> Center 2 with total distance: 19.86 km

Number of orders in this route: 13

Route 4: Center 2 -> Point 48 -> Point 48 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 3

Routes for center 3 at 270 minutes:

Route 1: Center 3 -> Point 24 -> Point 24 -> Point 28 -> Point 28 -> Point 28 -> Point 28 -> Point 43 -> Point 43 -> Point 43 -> Point 43 -> Center 3 with total distance: 16.96 km

Number of orders in this route: 10

Route 2: Center 3 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 1

Route 3: Center 3 -> Point 30 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 3

Route 4: Center 3 -> Point 27 -> Point 27 -> Point 23 -> Point 23 -> Point 23 -> Center 3 with total distance: 17.49 km

Number of orders in this route: 5

Route 5: Center 3 -> Point 22 -> Point 22 -> Point 22 -> Point 22 -> Point 22 -> Point 29 -> Point 29 -> Point 29 -> Point 26 -> Point 26 -> Point 25 -> Point 25 -> Point 25 -> Point 25 -> Point 25 -> Center 3 with total distance: 18.20 km

Number of orders in this route: 15

Routes for center 3 at 270 minutes:

Route 1: Center 3 -> Point 21 -> Point 21 -> Center 3 with total distance: 17.90 km

Number of orders in this route: 2

Routes for center 3 at 270 minutes:

Route 1: Center 3 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.03 km

Number of orders in this route: 2

Routes for center 4 at 270 minutes:

Route 1: Center 4 -> Point 34 -> Point 38 -> Point 32 -> Point 32 -> Point 38 -> Point 38 -> Center 4 with total distance: 19.23 km

Number of orders in this route: 6

Route 2: Center 4 -> Point 40 -> Point 40 -> Point 40 -> Point 40 -> Point 40 -> Point 36 -> Point 37 -> Point 37 -> Point 37 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 9

Route 3: Center 4 -> Point 31 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 2

Routes for center 5 at 270 minutes:

Route 1: Center 5 -> Point 42 -> Point 42 -> Point 42 -> Point 42 -> Point 42 -> Point 46 -> Point 45 -> Point 46 -> Point 46 -> Point 46 -> Center 5 with total distance: 14.21 km

Number of orders in this route: 10

Route 2: Center 5 -> Point 50 -> Point 50 -> Point 50 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 4

Route 3: Center 5 -> Point 49 -> Point 49 -> Point 49 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 4

Route 4: Center 5 -> Point 41 -> Point 41 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 3

Number of remaining orders at 270 minutes:47

Number of new orders generated at 300 minutes: 162

Number of orders to be processed by center 1: 53

Number of orders to be processed by center 2: 23

Number of orders to be processed by center 3: 32

Number of orders to be processed by center 4: 17

Number of orders to be processed by center 5: 18

Routes for center 1 at 300 minutes:

Route 1: Center 1 -> Point 6 -> Point 6 -> Point 6 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Center 1 with total distance: 17.22 km

Number of orders in this route: 13

Route 2: Center 1 -> Point 7 -> Point 7 -> Point 7 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 15 -> Point 15 -> Point 15 -> Point 15 -> Center 1 with total distance: 17.90 km

Number of orders in this route: 11

Route 3: Center 1 -> Point 4 -> Point 4 -> Point 4 -> Point 4 -> Center 1 with total distance: 12.38 km

Number of orders in this route: 4

Routes for center 1 at 300 minutes:

Route 1: Center 1 -> Point 9 -> Point 16 -> Point 16 -> Point 3 -> Point 3 -> Point 3 -> Point 39 -> Point 39 -> Point 39 -> Center 1 with total distance: 17.96 km

Number of orders in this route: 9

Route 2: Center 1 -> Point 5 -> Point 5 -> Point 5 -> Center 1 with total distance: 19.41 km

Number of orders in this route: 3

Route 3: Center 1 -> Point 33 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 3

Route 4: Center 1 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Point 1 -> Point 1 -> Point 10 -> Point 1 -> Point 1 -> Point 1 -> Center 1 with total distance: 15.90 km

Number of orders in this route: 10

Routes for center 2 at 300 minutes:

Route 1: Center 2 -> Point 19 -> Point 11 -> Center 2 with total distance: 18.86 km

Number of orders in this route: 2

Route 2: Center 2 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 5

Route 3: Center 2 -> Point 13 -> Point 13 -> Point 13 -> Point 13 -> Point 13 -> Point 17 -> Point 17 -> Point 17 -> Point 17 -> Center 2 with total distance: 16.82 km

Number of orders in this route: 9

Route 4: Center 2 -> Point 48 -> Point 48 -> Point 48 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 4

Routes for center 2 at 300 minutes:

Route 1: Center 2 -> Point 18 -> Point 18 -> Point 12 -> Center 2 with total distance: 19.75 km

Number of orders in this route: 3

Routes for center 3 at 300 minutes:

Route 1: Center 3 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 1

Route 2: Center 3 -> Point 24 -> Point 24 -> Point 24 -> Point 24 -> Point 28 -> Point 28 -> Point 28 -> Point 43 -> Point 22 -> Point 22 -> Center 3 with total distance: 17.90 km

Number of orders in this route: 10

Route 3: Center 3 -> Point 25 -> Point 26 -> Point 29 -> Point 29 -> Point 29 -> Center 3 with total distance: 17.39 km

Number of orders in this route: 5

Routes for center 3 at 300 minutes:

Route 1: Center 3 -> Point 30 -> Point 30 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 4

Route 2: Center 3 -> Point 27 -> Point 27 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Center 3 with total distance: 17.49 km

Number of orders in this route: 7

Routes for center 3 at 300 minutes:

Route 1: Center 3 -> Point 21 -> Point 21 -> Center 3 with total distance: 17.90 km

Number of orders in this route: 2

Routes for center 3 at 300 minutes:

Route 1: Center 3 -> Point 47 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.03 km

Number of orders in this route: 3

Routes for center 4 at 300 minutes:

Route 1: Center 4 -> Point 38 -> Point 38 -> Point 32 -> Point 32 -> Point 38 -> Point 34 -> Point 34 -> Point 34 -> Point 34 -> Point 34 -> Center 4 with total distance: 19.23 km

Number of orders in this route: 10

Route 2: Center 4 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 1

Route 3: Center 4 -> Point 37 -> Point 37 -> Point 36 -> Point 36 -> Point 40 -> Point 40 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 6

Routes for center 5 at 300 minutes:

Route 1: Center 5 -> Point 42 -> Point 46 -> Point 46 -> Point 46 -> Point 45 -> Point 45 -> Point 46 -> Point 46 -> Point 45 -> Point 45 -> Center 5 with total distance: 15.56 km

Number of orders in this route: 10

Route 2: Center 5 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 1

Route 3: Center 5 -> Point 49 -> Point 49 -> Point 49 -> Point 49 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 5

Route 4: Center 5 -> Point 41 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 2

Number of remaining orders at 300 minutes:47

Number of new orders generated at 330 minutes: 155

Number of orders to be processed by center 1: 49

Number of orders to be processed by center 2: 15

Number of orders to be processed by center 3: 39

Number of orders to be processed by center 4: 16

Number of orders to be processed by center 5: 17

Routes for center 1 at 330 minutes:

Route 1: Center 1 -> Point 8 -> Point 8 -> Point 5 -> Point 5 -> Point 5 -> Point 5 -> Point 6 -> Point 6 -> Center 1 with total distance: 19.86 km

Number of orders in this route: 8

Route 2: Center 1 -> Point 10 -> Point 10 -> Point 1 -> Point 2 -> Point 2 -> Point 2 -> Center 1 with total distance: 15.39 km

Number of orders in this route: 6

Route 3: Center 1 -> Point 7 -> Point 7 -> Point 7 -> Point 3 -> Point 3 -> Point 3 -> Point 9 -> Point 9 -> Point 16 -> Point 16 -> Point 9 -> Point 9 -> Point 16 -> Point 9 -> Center 1 with total distance: 18.04 km

Number of orders in this route: 14

Route 4: Center 1 -> Point 39 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 39 -> Center 1 with total distance: 15.36 km

Number of orders in this route: 7

Route 5: Center 1 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 2

Route 6: Center 1 -> Point 7 -> Point 4 -> Point 4 -> Point 4 -> Point 4 -> Point 4 -> Center 1 with total distance: 13.84 km

Number of orders in this route: 6

Routes for center 1 at 330 minutes:

Route 1: Center 1 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 15 -> Center 1 with total distance: 17.84 km

Number of orders in this route: 6

Routes for center 2 at 330 minutes:

Route 1: Center 2 -> Point 17 -> Point 19 -> Point 19 -> Point 11 -> Center 2 with total distance: 18.99 km

Number of orders in this route: 4

Route 2: Center 2 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 1

Route 3: Center 2 -> Point 18 -> Point 18 -> Point 18 -> Point 12 -> Point 13 -> Point 13 -> Point 13 -> Center 2 with total distance: 19.86 km

Number of orders in this route: 7

Route 4: Center 2 -> Point 14 -> Point 14 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 3

Routes for center 3 at 330 minutes:

Route 1: Center 3 -> Point 43 -> Point 43 -> Point 24 -> Point 28 -> Point 24 -> Point 24 -> Point 24 -> Point 24 -> Point 43 -> Point 22 -> Point 22 -> Point 22 -> Point 22 -> Point 22 -> Center 3 with total distance: 19.10 km

Number of orders in this route: 14

Route 2: Center 3 -> Point 26 -> Point 26 -> Point 26 -> Point 25 -> Point 25 -> Point 25 -> Center 3 with total distance: 16.52 km

Number of orders in this route: 6

Route 3: Center 3 -> Point 30 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 3

Route 4: Center 3 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Point 47 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.14 km

Number of orders in this route: 7

Route 5: Center 3 -> Point 44 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 2

Routes for center 3 at 330 minutes:

Route 1: Center 3 -> Point 29 -> Point 29 -> Point 29 -> Center 3 with total distance: 6.97 km

Number of orders in this route: 3

Route 2: Center 3 -> Point 21 -> Point 21 -> Point 21 -> Point 27 -> Center 3 with total distance: 18.77 km

Number of orders in this route: 4

Routes for center 4 at 330 minutes:

Route 1: Center 4 -> Point 40 -> Point 36 -> Point 36 -> Point 37 -> Point 37 -> Point 37 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 6

Route 2: Center 4 -> Point 34 -> Point 34 -> Point 34 -> Point 38 -> Point 32 -> Center 4 with total distance: 19.21 km

Number of orders in this route: 5

Route 3: Center 4 -> Point 31 -> Point 31 -> Point 31 -> Point 31 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 5

Routes for center 5 at 330 minutes:

Route 1: Center 5 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 1

Route 2: Center 5 -> Point 42 -> Point 42 -> Point 42 -> Point 42 -> Point 42 -> Point 45 -> Point 46 -> Point 46 -> Point 45 -> Point 45 -> Center 5 with total distance: 15.35 km

Number of orders in this route: 10

Route 3: Center 5 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 1

Route 4: Center 5 -> Point 41 -> Point 41 -> Point 41 -> Point 41 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 5

Number of remaining orders at 330 minutes:47

Number of new orders generated at 360 minutes: 163

Number of orders to be processed by center 1: 58

Number of orders to be processed by center 2: 19

Number of orders to be processed by center 3: 35

Number of orders to be processed by center 4: 16

Number of orders to be processed by center 5: 16

Routes for center 1 at 360 minutes:

Route 1: Center 1 -> Point 3 -> Point 3 -> Point 3 -> Point 3 -> Point 39 -> Point 39 -> Point 39 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Point 8 -> Point 6 -> Point 6 -> Point 6 -> Point 6 -> Center 1 with total distance: 18.28 km

Number of orders in this route: 21

Route 2: Center 1 -> Point 4 -> Point 4 -> Point 7 -> Point 7 -> Point 7 -> Point 7 -> Center 1 with total distance: 13.84 km

Number of orders in this route: 6

Route 3: Center 1 -> Point 7 -> Point 20 -> Point 20 -> Point 20 -> Point 15 -> Point 15 -> Point 15 -> Center 1 with total distance: 17.90 km

Number of orders in this route: 7

Routes for center 1 at 360 minutes:

Route 1: Center 1 -> Point 1 -> Point 10 -> Point 10 -> Point 10 -> Point 1 -> Point 1 -> Point 1 -> Point 1 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Center 1 with total distance: 15.90 km

Number of orders in this route: 12

Route 2: Center 1 -> Point 33 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 3

Route 3: Center 1 -> Point 5 -> Point 5 -> Center 1 with total distance: 19.41 km

Number of orders in this route: 2

Route 4: Center 1 -> Point 16 -> Point 16 -> Point 9 -> Point 9 -> Point 9 -> Point 16 -> Point 16 -> Center 1 with total distance: 15.86 km

Number of orders in this route: 7

Routes for center 2 at 360 minutes:

Route 1: Center 2 -> Point 17 -> Point 17 -> Point 19 -> Point 19 -> Point 19 -> Point 11 -> Center 2 with total distance: 18.99 km

Number of orders in this route: 6

Route 2: Center 2 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 1

Route 3: Center 2 -> Point 18 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Point 13 -> Point 13 -> Center 2 with total distance: 19.86 km

Number of orders in this route: 7

Route 4: Center 2 -> Point 48 -> Point 48 -> Point 48 -> Point 48 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 5

Routes for center 3 at 360 minutes:

Route 1: Center 3 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 2

Route 2: Center 3 -> Point 44 -> Point 44 -> Point 44 -> Point 44 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 5

Route 3: Center 3 -> Point 27 -> Point 27 -> Point 21 -> Point 21 -> Center 3 with total distance: 18.77 km

Number of orders in this route: 4

Route 4: Center 3 -> Point 43 -> Point 43 -> Point 43 -> Point 43 -> Point 43 -> Point 28 -> Point 28 -> Point 28 -> Point 24 -> Center 3 with total distance: 16.96 km

Number of orders in this route: 9

Route 5: Center 3 -> Point 22 -> Point 29 -> Point 29 -> Point 29 -> Point 26 -> Point 26 -> Point 26 -> Point 26 -> Point 26 -> Point 25 -> Point 25 -> Center 3 with total distance: 18.20 km

Number of orders in this route: 11

Routes for center 3 at 360 minutes:

Route 1: Center 3 -> Point 23 -> Point 47 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.14 km

Number of orders in this route: 4

Routes for center 4 at 360 minutes:

Route 1: Center 4 -> Point 40 -> Point 36 -> Point 36 -> Point 36 -> Point 36 -> Point 36 -> Point 37 -> Point 37 -> Point 37 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 9

Route 2: Center 4 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 1

Route 3: Center 4 -> Point 34 -> Point 38 -> Point 32 -> Point 38 -> Point 38 -> Point 38 -> Center 4 with total distance: 19.23 km

Number of orders in this route: 6

Routes for center 5 at 360 minutes:

Route 1: Center 5 -> Point 42 -> Point 42 -> Point 42 -> Point 45 -> Point 45 -> Point 46 -> Point 46 -> Point 45 -> Point 45 -> Center 5 with total distance: 15.35 km

Number of orders in this route: 9

Route 2: Center 5 -> Point 50 -> Point 50 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 3

Route 3: Center 5 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 1

Route 4: Center 5 -> Point 41 -> Point 41 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 3

Number of remaining orders at 360 minutes:47

Number of new orders generated at 390 minutes: 156

Number of orders to be processed by center 1: 43

Number of orders to be processed by center 2: 24

Number of orders to be processed by center 3: 31

Number of orders to be processed by center 4: 23

Number of orders to be processed by center 5: 16

Routes for center 1 at 390 minutes:

Route 1: Center 1 -> Point 4 -> Point 4 -> Point 4 -> Point 4 -> Point 20 -> Point 20 -> Point 7 -> Point 7 -> Point 7 -> Center 1 with total distance: 17.06 km

Number of orders in this route: 9

Route 2: Center 1 -> Point 15 -> Point 15 -> Center 1 with total distance: 17.49 km

Number of orders in this route: 2

Routes for center 1 at 390 minutes:

Route 1: Center 1 -> Point 39 -> Point 35 -> Point 35 -> Point 35 -> Point 39 -> Point 39 -> Point 39 -> Point 3 -> Center 1 with total distance: 16.64 km

Number of orders in this route: 8

Route 2: Center 1 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 2

Route 3: Center 1 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Point 1 -> Point 1 -> Point 1 -> Point 1 -> Point 10 -> Center 1 with total distance: 15.39 km

Number of orders in this route: 9

Routes for center 1 at 390 minutes:

Route 1: Center 1 -> Point 6 -> Point 6 -> Point 8 -> Point 8 -> Point 5 -> Point 5 -> Point 5 -> Point 5 -> Point 5 -> Center 1 with total distance: 19.84 km

Number of orders in this route: 9

Route 2: Center 1 -> Point 16 -> Point 9 -> Point 9 -> Center 1 with total distance: 15.57 km

Number of orders in this route: 3

Routes for center 2 at 390 minutes:

Route 1: Center 2 -> Point 17 -> Point 18 -> Point 18 -> Point 18 -> Point 18 -> Point 18 -> Center 2 with total distance: 15.13 km

Number of orders in this route: 6

Route 2: Center 2 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 5

Route 3: Center 2 -> Point 17 -> Point 19 -> Point 19 -> Point 19 -> Point 11 -> Center 2 with total distance: 18.99 km

Number of orders in this route: 5

Route 4: Center 2 -> Point 48 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 2

Routes for center 2 at 390 minutes:

Route 1: Center 2 -> Point 13 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Center 2 with total distance: 19.85 km

Number of orders in this route: 6

Routes for center 3 at 390 minutes:

Route 1: Center 3 -> Point 24 -> Point 24 -> Point 28 -> Point 43 -> Center 3 with total distance:

16.96 km

Number of orders in this route: 4

Route 2: Center 3 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 2

Route 3: Center 3 -> Point 44 -> Point 44 -> Point 44 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 4

Route 4: Center 3 -> Point 27 -> Point 23 -> Center 3 with total distance: 17.49 km

Number of orders in this route: 2

Route 5: Center 3 -> Point 22 -> Point 22 -> Point 22 -> Point 22 -> Point 29 -> Point 29 -> Point 29 -> Point 26 -> Point 26 -> Point 26 -> Point 25 -> Point 25 -> Center 3 with total distance: 18.20 km

Number of orders in this route: 12

Routes for center 3 at 390 minutes:

Route 1: Center 3 -> Point 21 -> Point 21 -> Point 21 -> Point 21 -> Point 21 -> Center 3 with total distance: 17.90 km

Number of orders in this route: 5

Routes for center 3 at 390 minutes:

Route 1: Center 3 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.03 km

Number of orders in this route: 2

Routes for center 4 at 390 minutes:

Route 1: Center 4 -> Point 34 -> Point 34 -> Point 34 -> Point 34 -> Point 38 -> Point 32 -> Point 38 -> Point 38 -> Center 4 with total distance: 19.23 km

Number of orders in this route: 8

Route 2: Center 4 -> Point 40 -> Point 40 -> Point 40 -> Point 40 -> Point 36 -> Point 37 -> Point 37 -> Point 37 -> Point 37 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 9

Route 3: Center 4 -> Point 31 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 2

Routes for center 5 at 390 minutes:

Route 1: Center 5 -> Point 42 -> Point 42 -> Point 42 -> Point 42 -> Point 46 -> Point 46 -> Point 45 -> Point 46 -> Point 46 -> Center 5 with total distance: 14.21 km

Number of orders in this route: 9

Route 2: Center 5 -> Point 50 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 2

Route 3: Center 5 -> Point 49 -> Point 49 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 3

Route 4: Center 5 -> Point 41 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 2

Number of remaining orders at 390 minutes:47

Number of new orders generated at 420 minutes: 176

Number of orders to be processed by center 1: 46

Number of orders to be processed by center 2: 28

Number of orders to be processed by center 3: 41

Number of orders to be processed by center 4: 21

Number of orders to be processed by center 5: 21

Routes for center 1 at 420 minutes:

Route 1: Center 1 -> Point 7 -> Point 7 -> Point 7 -> Point 7 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 15 -> Point 15 -> Point 15 -> Point 15 -> Center 1 with total distance: 17.90 km

Number of orders in this route: 13

Route 2: Center 1 -> Point 6 -> Point 4 -> Point 4 -> Point 7 -> Center 1 with total distance: 18.17 km

Number of orders in this route: 4

Routes for center 1 at 420 minutes:

Route 1: Center 1 -> Point 8 -> Point 8 -> Point 5 -> Point 5 -> Center 1 with total distance: 19.83 km

Number of orders in this route: 4

Route 2: Center 1 -> Point 3 -> Point 3 -> Point 3 -> Point 3 -> Point 3 -> Point 35 -> Point 39 -> Point 39 -> Point 39 -> Center 1 with total distance: 16.32 km

Number of orders in this route: 9

Route 3: Center 1 -> Point 33 -> Point 33 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 4

Route 4: Center 1 -> Point 2 -> Point 2 -> Point 10 -> Point 1 -> Point 1 -> Point 1 -> Center 1 with total distance: 15.43 km

Number of orders in this route: 6

Routes for center 1 at 420 minutes:

Route 1: Center 1 -> Point 16 -> Point 9 -> Point 16 -> Point 9 -> Point 16 -> Point 16 -> Center 1 with total distance: 16.60 km

Number of orders in this route: 6

Routes for center 2 at 420 minutes:

Route 1: Center 2 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 5

Route 2: Center 2 -> Point 11 -> Point 11 -> Point 11 -> Point 11 -> Point 19 -> Point 19 -> Point 19 -> Point 19 -> Point 17 -> Point 17 -> Center 2 with total distance: 18.99 km

Number of orders in this route: 10

Route 3: Center 2 -> Point 13 -> Point 13 -> Point 13 -> Point 12 -> Point 12 -> Point 12 -> Point 18 -> Point 18 -> Point 18 -> Point 18 -> Point 18 -> Center 2 with total distance: 19.86 km

Number of orders in this route: 11

Route 4: Center 2 -> Point 48 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 2

Routes for center 3 at 420 minutes:

Route 1: Center 3 -> Point 44 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 2

Route 2: Center 3 -> Point 43 -> Point 28 -> Point 28 -> Point 28 -> Point 28 -> Point 28 -> Point

24 -> Point 24 -> Point 24 -> Point 24 -> Point 24 -> Point 43 -> Point 43 -> Point 43 -> Center 3 with total distance: 17.32 km

Number of orders in this route: 14

Route 3: Center 3 -> Point 30 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 3

Route 4: Center 3 -> Point 27 -> Point 21 -> Point 21 -> Point 21 -> Point 21 -> Center 3 with total distance: 18.77 km

Number of orders in this route: 5

Route 5: Center 3 -> Point 22 -> Point 22 -> Point 22 -> Point 29 -> Point 26 -> Point 26 -> Point 25 -> Center 3 with total distance: 18.20 km

Number of orders in this route: 7

Routes for center 3 at 420 minutes:

Route 1: Center 3 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.14 km

Number of orders in this route: 7

Routes for center 4 at 420 minutes:

Route 1: Center 4 -> Point 37 -> Point 37 -> Point 37 -> Point 37 -> Point 37 -> Point 36 -> Point 36 -> Point 40 -> Point 40 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 9

Route 2: Center 4 -> Point 38 -> Point 32 -> Point 38 -> Point 38 -> Center 4 with total distance: 19.21 km

Number of orders in this route: 4

Route 3: Center 4 -> Point 34 -> Point 34 -> Point 34 -> Center 4 with total distance: 7.05 km

Number of orders in this route: 3

Routes for center 4 at 420 minutes:

Route 1: Center 4 -> Point 31 -> Point 31 -> Point 31 -> Point 31 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 5

Routes for center 5 at 420 minutes:

Route 1: Center 5 -> Point 42 -> Point 42 -> Point 46 -> Point 45 -> Point 45 -> Point 46 -> Point 46 -> Point 45 -> Point 45 -> Center 5 with total distance: 15.56 km

Number of orders in this route: 9

Route 2: Center 5 -> Point 50 -> Point 50 -> Point 50 -> Point 50 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 5

Route 3: Center 5 -> Point 49 -> Point 49 -> Point 49 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 4

Route 4: Center 5 -> Point 41 -> Point 41 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 3

Number of remaining orders at 420 minutes:47

Number of new orders generated at 450 minutes: 165

Number of orders to be processed by center 1: 52

Number of orders to be processed by center 2: 25

Number of orders to be processed by center 3: 32

Number of orders to be processed by center 4: 18

Number of orders to be processed by center 5: 19

Routes for center 1 at 450 minutes:

Route 1: Center 1 -> Point 7 -> Point 7 -> Point 7 -> Point 7 -> Point 7 -> Point 3 -> Point 9 -> Point 16 -> Point 16 -> Point 9 -> Point 9 -> Point 9 -> Center 1 with total distance: 17.30 km

Number of orders in this route: 12

Route 2: Center 1 -> Point 39 -> Point 39 -> Point 39 -> Point 39 -> Point 39 -> Point 35 -> Point 35 -> Point 35 -> Point 35 -> Point 6 -> Center 1 with total distance: 15.59 km

Number of orders in this route: 10

Route 3: Center 1 -> Point 4 -> Point 4 -> Point 4 -> Point 4 -> Point 4 -> Center 1 with total distance: 12.38 km

Number of orders in this route: 5

Route 4: Center 1 -> Point 8 -> Point 8 -> Point 5 -> Point 5 -> Point 5 -> Center 1 with total distance: 19.83 km

Number of orders in this route: 5

Route 5: Center 1 -> Point 33 -> Point 33 -> Point 33 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 4

Route 6: Center 1 -> Point 10 -> Point 1 -> Point 1 -> Point 1 -> Point 1 -> Point 10 -> Point 2 -> Point 2 -> Point 2 -> Center 1 with total distance: 15.72 km

Number of orders in this route: 9

Routes for center 1 at 450 minutes:

Route 1: Center 1 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 15 -> Point 15 -> Center 1 with total distance: 17.84 km

Number of orders in this route: 7

Routes for center 2 at 450 minutes:

Route 1: Center 2 -> Point 17 -> Point 18 -> Point 18 -> Point 18 -> Point 18 -> Center 2 with total distance: 15.13 km

Number of orders in this route: 5

Route 2: Center 2 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 5

Route 3: Center 2 -> Point 17 -> Point 17 -> Point 19 -> Point 19 -> Point 11 -> Center 2 with total distance: 18.99 km

Number of orders in this route: 5

Route 4: Center 2 -> Point 48 -> Point 48 -> Point 48 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 4

Routes for center 2 at 450 minutes:

Route 1: Center 2 -> Point 13 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Center 2 with total distance: 19.85 km

Number of orders in this route: 6

Routes for center 3 at 450 minutes:

Route 1: Center 3 -> Point 30 -> Point 30 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 4

Route 2: Center 3 -> Point 44 -> Point 44 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 3

Route 3: Center 3 -> Point 24 -> Point 28 -> Point 28 -> Point 28 -> Point 43 -> Center 3 with total distance: 16.96 km

Number of orders in this route: 5

Route 4: Center 3 -> Point 23 -> Point 23 -> Point 47 -> Point 47 -> Point 47 -> Center 3 with total distance: 19.14 km

Number of orders in this route: 5

Route 5: Center 3 -> Point 22 -> Point 22 -> Point 29 -> Point 29 -> Point 29 -> Point 29 -> Point 26 -> Point 25 -> Point 25 -> Center 3 with total distance: 18.20 km

Number of orders in this route: 9

Routes for center 3 at 450 minutes:

Route 1: Center 3 -> Point 27 -> Point 27 -> Point 27 -> Point 27 -> Point 27 -> Point 21 -> Center 3 with total distance: 18.77 km

Number of orders in this route: 6

Routes for center 4 at 450 minutes:

Route 1: Center 4 -> Point 40 -> Point 36 -> Point 36 -> Point 37 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 4

Route 2: Center 4 -> Point 34 -> Point 34 -> Point 34 -> Point 34 -> Point 34 -> Point 38 -> Point 32 -> Point 32 -> Point 32 -> Point 32 -> Point 32 -> Point 38 -> Center 4 with total distance: 19.23 km

Number of orders in this route: 12

Route 3: Center 4 -> Point 31 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 2

Routes for center 5 at 450 minutes:

Route 1: Center 5 -> Point 42 -> Point 42 -> Point 42 -> Point 46 -> Point 45 -> Point 46 -> Point 45 -> Point 45 -> Center 5 with total distance: 15.56 km

Number of orders in this route: 8

Route 2: Center 5 -> Point 50 -> Point 50 -> Point 50 -> Point 50 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 5

Route 3: Center 5 -> Point 49 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 2

Route 4: Center 5 -> Point 41 -> Point 41 -> Point 41 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 4

Number of remaining orders at 450 minutes:47

Number of new orders generated at 480 minutes: 172

Number of orders to be processed by center 1: 43

Number of orders to be processed by center 2: 35

Number of orders to be processed by center 3: 40

Number of orders to be processed by center 4: 19

Number of orders to be processed by center 5: 16

Routes for center 1 at 480 minutes:

Route 1: Center 1 -> Point 35 -> Point 39 -> Center 1 with total distance: 15.24 km

Number of orders in this route: 2

Route 2: Center 1 -> Point 7 -> Point 7 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 20 -> Point 15 -> Point 15 -> Point 15 -> Point 15 -> Point 15 -> Center 1 with total distance: 17.90 km

Number of orders in this route: 12

Route 3: Center 1 -> Point 10 -> Point 1 -> Point 1 -> Point 1 -> Point 1 -> Point 2 -> Point 2 -> Point 2 -> Point 2 -> Center 1 with total distance: 15.39 km

Number of orders in this route: 9

Route 4: Center 1 -> Point 33 -> Center 1 with total distance: 18.88 km

Number of orders in this route: 1

Route 5: Center 1 -> Point 6 -> Point 6 -> Point 8 -> Point 8 -> Point 5 -> Point 5 -> Center 1 with total distance: 19.84 km

Number of orders in this route: 6

Route 6: Center 1 -> Point 4 -> Point 4 -> Center 1 with total distance: 12.38 km

Number of orders in this route: 2

Routes for center 1 at 480 minutes:

Route 1: Center 1 -> Point 3 -> Point 16 -> Point 16 -> Point 16 -> Point 16 -> Point 9 -> Point 9 -> Point 9 -> Point 16 -> Point 9 -> Point 9 -> Center 1 with total distance: 16.73 km

Number of orders in this route: 11

Routes for center 2 at 480 minutes:

Route 1: Center 2 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Point 14 -> Center 2 with total distance: 19.32 km

Number of orders in this route: 5

Route 2: Center 2 -> Point 11 -> Point 11 -> Point 11 -> Point 11 -> Point 11 -> Point 19 -> Point 19 -> Point 19 -> Point 19 -> Point 17 -> Point 17 -> Point 17 -> Point 17 -> Point 17 -> Center 2 with total distance: 18.99 km

Number of orders in this route: 14

Route 3: Center 2 -> Point 13 -> Point 13 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Point 12 -> Point 18 -> Point 18 -> Point 18 -> Point 18 -> Point 18 -> Center 2 with total distance: 19.86 km

Number of orders in this route: 12

Route 4: Center 2 -> Point 48 -> Point 48 -> Point 48 -> Point 48 -> Center 2 with total distance: 18.23 km

Number of orders in this route: 4

Routes for center 3 at 480 minutes:

Route 1: Center 3 -> Point 44 -> Center 3 with total distance: 19.80 km

Number of orders in this route: 1

Route 2: Center 3 -> Point 30 -> Point 30 -> Point 30 -> Point 30 -> Point 30 -> Center 3 with total distance: 6.88 km

Number of orders in this route: 5

Route 3: Center 3 -> Point 43 -> Point 43 -> Point 28 -> Point 24 -> Point 24 -> Point 24 -> Center 3 with total distance: 16.96 km

Number of orders in this route: 6

Route 4: Center 3 -> Point 21 -> Center 3 with total distance: 17.90 km

Number of orders in this route: 1

Route 5: Center 3 -> Point 22 -> Point 22 -> Point 22 -> Point 22 -> Point 29 -> Point 29 -> Point 29 -> Point 29 -> Point 26 -> Point 26 -> Point 26 -> Point 26 -> Point 26 -> Point 25 -> Point 25 -> Point 25 -> Center 3 with total distance: 18.20 km

Number of orders in this route: 16

Routes for center 3 at 480 minutes:

Route 1: Center 3 -> Point 27 -> Point 27 -> Point 27 -> Point 27 -> Point 27 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Point 23 -> Center 3 with total distance: 17.49 km

Number of orders in this route: 10

Routes for center 3 at 480 minutes:

Route 1: Center 3 -> Point 47 -> Center 3 with total distance: 19.03 km

Number of orders in this route: 1

Routes for center 4 at 480 minutes:

Route 1: Center 4 -> Point 37 -> Point 37 -> Point 37 -> Point 37 -> Point 36 -> Point 36 -> Point 36 -> Point 36 -> Point 36 -> Point 40 -> Point 40 -> Point 40 -> Point 40 -> Center 4 with total distance: 12.69 km

Number of orders in this route: 13

Route 2: Center 4 -> Point 34 -> Point 38 -> Point 32 -> Center 4 with total distance: 19.21 km

Number of orders in this route: 3

Route 3: Center 4 -> Point 31 -> Point 31 -> Point 31 -> Center 4 with total distance: 19.79 km

Number of orders in this route: 3

Routes for center 5 at 480 minutes:

Route 1: Center 5 -> Point 42 -> Point 42 -> Point 42 -> Point 42 -> Point 45 -> Point 45 -> Point 46 -> Point 45 -> Center 5 with total distance: 15.35 km

Number of orders in this route: 8

Route 2: Center 5 -> Point 50 -> Point 50 -> Point 50 -> Center 5 with total distance: 19.80 km

Number of orders in this route: 3

Route 3: Center 5 -> Point 49 -> Point 49 -> Center 5 with total distance: 17.95 km

Number of orders in this route: 2

Route 4: Center 5 -> Point 41 -> Point 41 -> Point 41 -> Center 5 with total distance: 18.62 km

Number of orders in this route: 3

Number of remaining orders at 480 minutes:0

其对应的图像输出如下：