Appendices

A Formulating Drone Range

Dukkanci et al. (2021) provide the calculations below to formulate drone range.

The range of a drone depends on the energy consumption. In order to calculate energy consumption, we use the power consumption formulation given by Zeng et al. (2019). The required power $P(v)$ (in kg.m^2/s^3) for drone to move as a function of the drone speed v (in m/s) is given as follows:

$$P(v) = \frac{\delta}{8}\rho s A \Omega^3 r^3 \left(1 + \frac{3v^2}{U_{tip}^2}\right) + (1+k)\frac{W^{3/2}}{\sqrt{2\rho A}} \left(\sqrt{1 + \frac{v^4}{4v_0^4}} - \frac{v^2}{2v_0^2}\right)^{1/2} + \frac{1}{2} d_0 \rho s A v^3, \tag{A.1}$$

where δ is the profile drag coefficient, ρ (in kg/m^3) is the air density, s is the rotor solidity, A (in m^2) is the rotor disc area, Ω (in radians/s) is the blade angular velocity, r (in m) is the rotor radius, U_{tip} (in m/s) is the speed of the rotor blade, k is the incremental correction factor to induced power, v_0 (in m/s) is the mean rotor induced velocity in hover, d_0 is the fuselage drag ratio and W is the total weight including aircraft weight m_{air} (in kg), package weight m_{pack} (in kg) and battery weight m_{batt} (in kg). Package weight (m_{pack}) is only taken to account on the forward journey to a customer ($W = m_{air} + m_{pack} + m_{batt}$), not in the return journey from a customer ($W = m_{air} + m_{batt}$). Equation (A.1) represents the propulsion power consumption, and consists of three components, namely the blade profile, induced and parasite power, respectively. To simplify the above formula, let $P_0 = \frac{\delta}{8}\rho s A \Omega^3 r^3$ and $P_i = (1+k)\frac{W^{3/2}}{\sqrt{2\rho A}}$ be associated with the blade profile power and induced power during hovering. Then, Zeng et al. (2019) present an approximation of equation (A.1) by applying the first-order Taylor approximation as follows:

$$P(v) \approx P_0 \left(1 + \frac{3v^2}{U_{tip}^2}\right) + P_i \frac{v_0}{v} + \frac{1}{2} d_0 \rho s A v^3. \tag{A.2}$$

Here, the power consumption formula (A.2) is converted to an energy consumption formula $E(v, d)$ (in kg.m^2/s^2) for a drone traveling a distance of d units (in m) at a constant speed v (in m/s), and calculated as $E(v, d) = P(v)t = P(v)\frac{d}{v}$:

$$E(v, d) \approx P_0 \left(\frac{d}{v} + \frac{3dv}{U_{tip}^2}\right) + P_i \frac{v_0 d}{v^2} + \frac{1}{2} d_0 \rho s A d v^2. \tag{A.3}$$

To simplify formula (A.3), let $\mu_1 = P_0$, $\mu_2 = P_0 \frac{3}{U_{tip}^2}$, $\mu_3 = P_i v_0$, and $\mu_4 = \frac{1}{2} d_0 \rho s A$. Then, the total amount of energy E (in kg.m^2/s^2) can be given as follows:

$$E(v, d) = \mu_1 \frac{d}{v} + \mu_2 dv + \mu_3 \frac{d}{v^2} + \mu_4 d v^2. \tag{A.4}$$

By using energy consumption formula (A.4) and the formula that shows the relation between energy consumption and range Stolaroff et al. (2018), the range of the drone can be calculated as follows:

$$R(v) = \frac{m_{batt} s_{batt} \theta}{(\frac{\mu_1}{v} + \mu_2 v + \frac{\mu_3}{v^2} + \mu_4 v^2) f}, \tag{A.5}$$

where s_{batt} (in J) is the energy capacity of the battery per mass, θ is the depth of discharge, and f is the safety factor to reserve energy for unusual conditions. To simplify formula (A.5), let $\Theta = m_{batt}s_{batt}\theta/f$. The range $R(v)$ (in m) of a drone as a function of the drone speed v (in m/s) is given as follows:

$$R(v) = \frac{\Theta}{\frac{\mu_1}{v}+\mu_2 v+\frac{\mu_3}{v^2}+\mu_4 v^2}. \tag{A.6}$$

Parameter values used for drone range calculations are given in Table A1 (Zeng et al. 2019, Stolaroff et al. 2018, Dukkanci et al. 2021).

Table A1: Parameter values used for calculating range of a drone

Notation	Description	Reference Values
δ	Profile drag coefficient	0.012
ρ	Air density (kg/m^3)	1.225
s	Rotor solidity	0.05
A	Rotor disc area (m^2)	0.503
Ω	Blade angular velocity (radian/s)	300
r	Rotor radius (m)	0.4
U_{tip}	Tip speed of the rotor blade (m/s)	120
k	Incremental correction factor to induced power	0.1
m_{air}	Aircraft weight (Newton)	20
m_{pack}	Package weight (kg)	1
m_{batt}	Battery weight (kg)	0.89
v_0	Mean rotor induced velocity in hover (m/s)	4.03
d_0	Fuselage drag ratio	0.6
s_{batt}	Energy capacity (density) per mass of the battery (J/kg)	540,000
θ	Depth of discharge	0.8
f	Safety factor to reserve energy	1.2

B Computational Results

Table B2 indicates the damage percentages of affected households at each damage state and each intensity level. Damage percentages of non-integer intensity levels are calculated by linearizing damage percentages of two consecutive intensity levels for "No damage" state.

Table B2: Damage percentages based on 1999 Izmit Earthquake (Özmen 2002)

I_s (MSK)	Definition	Damage States			
		No damage	Slight damage	Medium damage	Heavy damage and collapse
6	VI-Strong	99.5%	0.24%	0.22%	0.04%
7	VII-Very strong	93.83%	2.59%	2.67%	0.91%
8	VIII-Damaging	87.46%	5.31%	4.41%	2.82%
9	IX-Destructive	43.39%	22.75%	18.16%	15.70%
10	X-Devastating	32.51%	19.14%	15.29%	33.06%

Table B3 shows the demand values of 40 gathering points (rows) for 12 scenarios (columns) in terms of the weight of the packages sent to gathering points. The second and third rows of Table B3 indicate the magnitude and depth of the earthquake scenario. The locations of 12 earthquakes are depicted in Figure 1. While earthquake scenarios 1, 3 and 4 (dark red color in the map) result in high demand values, earthquake scenarios 6, 8 and 11 yield low demand values (green color on the left side of the map). Earthquake scenarios 5, 10 and 12 have higher earthquake magnitudes (orange color on the map) and earthquake scenarios 2 and 9 have lower magnitudes (blue color on the map). We also include a scenario (Scenario 7) which is located on the right side of the map.

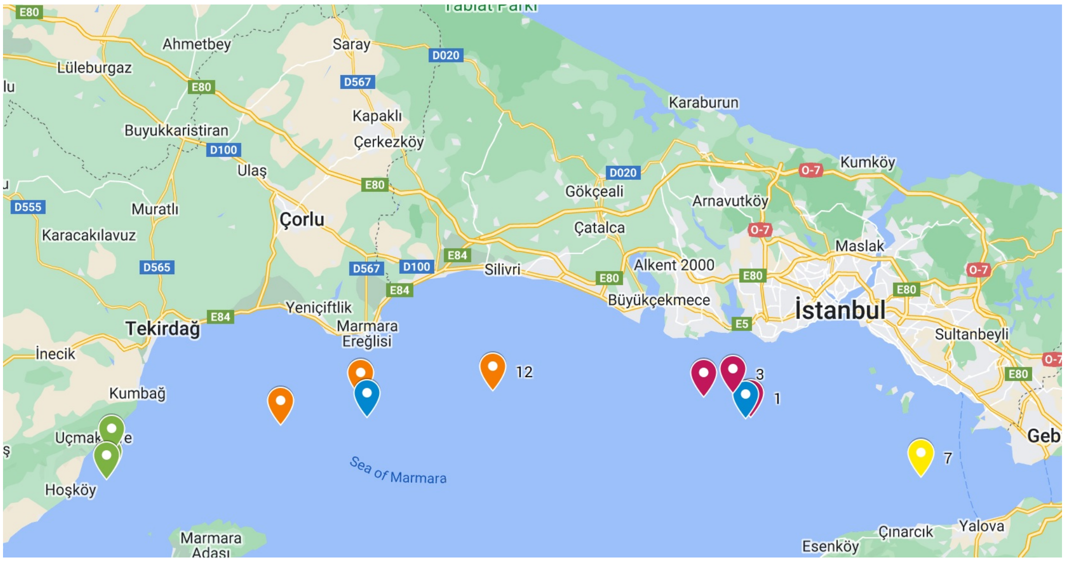

Figure 1: Locations of earthquakes for 12 scenarios

Table B4 shows the percentage increase in the road distance of 21 potential road connections (rows) between three depots and seven launch points for 12 scenarios (columns).

Table B5 summarizes the descriptions and typical values of parameters.

Table B5: Parameter values

Notation	Description	Typical Values
$\|S\|$	Number of scenarios	50
v^t	Truck speed (km/h)	45
T	Time bound (h)	1
v^{BD}_{max}	Maximum speed of large drones (km/h)	108
τ	Setup time of a drone (s)	120
Q_{SD}	Capacity of small drone (kg)	2
Q_{BD}	Capacity of large drone (kg)	200
Q_T	Capacity of truck (kg)	2,000

Table B6 lists the descriptions of parameters used in the clustering approach.

Table B6: Clustering approach parameters

Notation	Description
G	Set of clusters
C_g	Set of customers in cluster $g \in G$
ϕ_g	Number of customers in cluster $g \in G$
t_{lk}	Travel time between launch point $l \in L$ and gathering point $k \in C$
ψ_{lg}	Travel time between launch point $l \in L$ and cluster $g \in G$
σ_{gs}	Total demand of cluster $g \in G$ in scenario $s \in S$
χ_{gs}	Maximum demand of cluster $g \in G$ in scenario $s \in S$

Algorithm 1 presents the steps of the clustering approach. It starts with a preprocessing approach,

Table B3: Demand matrix for the small data set with 12 scenarios

	1	2	3	4	5	6	7	8	9	10	11	12
Magnitude	7.5	6.8	7.7	7.6	7.7	6.8	7.3	7.0	6.8	7.7	6.8	7.7
Depth	5.3	14.4	5.4	16	12.7	8.7	12.6	8.2	12.7	12.7	16.9	8.7
1	1.32	0.95	2.17	2.01	0.55	0.03	1.05	0.03	0.21	0.44	0.03	0.78
2	2.04	1.01	2.89	2.59	0.56	0.03	1.03	0.03	0.24	0.45	0.03	0.79
3	2.75	1.95	5.09	5.04	1.31	0.07	1.86	0.08	0.59	1.04	0.08	1.80
4	3.42	2.03	5.53	5.22	1.25	0.06	2.00	0.07	0.54	0.99	0.07	1.73
5	2.86	1.97	5.19	5.12	1.31	0.07	1.87	0.08	0.59	1.04	0.08	1.80
6	4.69	1.98	7.79	8.64	1.56	0.09	1.42	0.22	0.91	1.27	0.20	2.86
7	2.00	1.00	2.88	2.61	0.57	0.03	1.01	0.03	0.24	0.45	0.03	0.80
8	5.55	2.24	8.34	7.74	1.39	0.07	1.86	0.08	0.70	1.11	0.08	1.91
9	2.71	1.09	3.57	3.11	0.59	0.03	1.06	0.04	0.26	0.47	0.03	0.83
10	2.24	1.41	3.67	3.45	0.86	0.04	1.42	0.05	0.36	0.68	0.05	1.19
11	9.50	4.15	15.91	17.10	3.17	0.16	3.06	0.38	1.79	2.57	0.34	4.55
12	1.15	0.91	1.87	1.76	0.54	0.03	1.03	0.03	0.20	0.43	0.03	0.76
13	8.64	4.03	14.73	15.67	3.06	0.16	3.06	0.31	1.70	2.47	0.27	4.15
14	5.02	2.01	7.12	6.39	1.17	0.06	1.78	0.07	0.56	0.93	0.07	1.62
15	2.12	1.02	2.87	2.55	0.55	0.03	1.08	0.03	0.23	0.44	0.03	0.78
16	0.93	0.72	1.06	1.06	0.45	0.02	0.85	0.03	0.15	0.36	0.03	0.64
17	0.86	0.64	1.03	1.18	1.90	0.28	0.49	0.37	0.88	1.08	0.35	3.71
18	3.46	1.67	4.74	4.10	0.66	0.03	0.99	0.04	0.33	0.53	0.04	0.92
19	6.96	3.71	9.42	9.17	1.37	0.07	1.64	0.10	0.75	1.11	0.09	1.89
20	3.03	1.98	5.24	5.06	1.26	0.06	1.92	0.08	0.56	1.01	0.07	1.75
21	0.87	0.67	0.99	1.00	0.46	0.02	0.76	0.03	0.15	0.36	0.03	0.64
22	0.65	0.48	1.04	0.96	0.28	0.01	0.56	0.02	0.10	0.22	0.02	0.39
23	1.21	0.98	2.63	3.60	1.09	0.14	0.71	0.22	0.68	0.89	0.21	3.00
24	3.66	2.06	5.67	5.26	1.23	0.06	2.06	0.07	0.53	0.98	0.07	1.71
25	5.41	2.23	8.26	7.76	1.41	0.07	1.83	0.08	0.72	1.13	0.08	1.93
26	1.50	0.97	2.33	2.14	0.56	0.03	1.07	0.03	0.22	0.44	0.03	0.78
27	5.97	2.67	8.68	7.89	1.57	0.08	2.47	0.09	0.72	1.25	0.09	2.17
28	0.86	0.65	0.97	0.98	0.44	0.02	0.77	0.03	0.13	0.34	0.03	0.61
29	4.55	2.02	6.19	5.39	0.92	0.05	1.44	0.06	0.45	0.74	0.05	1.28
30	3.03	1.29	4.04	3.51	0.62	0.03	1.03	0.04	0.29	0.50	0.04	0.86
31	4.42	1.91	6.15	5.43	0.94	0.05	1.41	0.06	0.46	0.75	0.06	1.30
32	0.81	0.60	0.92	0.93	0.42	0.02	0.75	0.02	0.11	0.32	0.02	0.58
33	0.76	0.60	1.30	1.24	0.37	0.02	0.66	0.02	0.14	0.29	0.02	0.51
34	1.18	0.67	1.72	1.56	0.37	0.02	0.72	0.02	0.15	0.30	0.02	0.53
35	4.97	2.17	7.71	7.33	1.39	0.07	1.81	0.08	0.70	1.11	0.08	1.91
36	3.06	1.28	4.16	3.67	0.71	0.04	1.22	0.04	0.32	0.56	0.04	0.99
37	2.71	1.47	4.09	3.76	0.86	0.04	1.48	0.05	0.37	0.69	0.05	1.20
38	3.05	1.27	4.19	3.71	0.71	0.04	1.21	0.04	0.32	0.57	0.04	0.99
39	5.29	2.21	8.09	7.61	1.40	0.07	1.83	0.08	0.71	1.12	0.08	1.92
40	1.01	0.78	1.20	2.10	1.20	0.21	0.58	0.30	0.79	0.99	0.28	3.69

Table B4: Road distance percentage matrix for the small data set with 12 scenarios

	1	2	3	4	5	6	7	8	9	10	11	12
Magnitude	7.5	6.8	7.7	7.6	7.7	6.8	7.3	7.0	6.8	7.7	6.8	7.7
Depth	5.3	14.4	5.4	16	12.7	8.7	12.6	8.2	12.7	12.7	16.9	8.7
1	21.62	11.22	35.15	34.54	7.24	0.36	10.47	0.55	3.44	5.79	0.49	10.01
2	27.43	12.01	42.30	40.88	7.74	0.39	10.27	0.58	3.90	6.22	0.53	10.65
3	31.22	13.12	50.38	51.24	8.89	0.46	9.39	0.86	4.93	7.19	0.75	12.15
4	20.87	10.69	31.51	31.57	7.13	0.35	9.96	0.54	3.31	5.68	0.49	9.83
5	34.79	15.67	50.88	47.34	8.07	0.42	10.41	0.60	4.21	6.48	0.55	11.09
6	20.29	10.13	30.27	30.54	6.98	0.34	9.43	0.53	3.16	5.55	0.48	9.61
7	27.18	11.97	41.41	39.88	7.60	0.39	10.50	0.58	3.79	6.11	0.52	10.49
8	20.67	11.06	32.36	30.20	6.69	0.33	10.87	0.40	2.95	5.31	0.39	9.29
9	26.48	11.85	39.50	36.54	7.19	0.36	10.67	0.43	3.41	5.73	0.42	9.92
10	30.27	12.95	47.59	46.89	8.34	0.43	9.79	0.71	4.44	6.71	0.65	11.43
11	19.92	10.52	28.71	27.23	6.58	0.32	10.36	0.39	2.82	5.20	0.38	9.11
12	33.84	15.51	48.09	43.00	7.52	0.38	10.81	0.45	3.72	6.00	0.44	10.36
13	19.34	9.97	27.48	26.20	6.43	0.31	9.83	0.38	2.67	5.07	0.37	8.89
14	26.23	11.81	38.61	35.54	7.05	0.36	10.90	0.42	3.30	5.63	0.42	9.77
15	22.41	11.92	36.66	38.19	7.69	0.41	10.28	0.84	3.85	6.19	0.78	12.75
16	28.22	12.71	43.80	44.53	8.19	0.44	10.08	0.87	4.31	6.61	0.81	13.39
17	32.01	13.81	51.89	54.88	9.35	0.51	9.20	1.15	5.34	7.59	1.04	14.89
18	21.66	11.39	33.01	35.22	7.58	0.40	9.77	0.83	3.72	6.08	0.77	12.57
19	35.58	16.37	52.39	50.99	8.52	0.46	10.21	0.89	4.62	6.88	0.83	13.83
20	21.08	10.83	31.78	34.19	7.43	0.39	9.24	0.82	3.57	5.95	0.76	12.35
21	27.97	12.67	42.91	43.53	8.06	0.43	10.31	0.86	4.20	6.50	0.80	13.23

where inaccessible gathering points are removed from the customer set (lines 1-11). The algorithm continues to find the gathering points with the highest demand value for each scenario to assign large drones to that gathering points (lines 13-16). Then, the k-means algorithm is applied to create clusters of customers (lines 17-19). After that, the model given in Section 5.4.1 is solved in order to find which clusters are visited by small drones in each scenario (line 20). Finally, in the post-processing part (lines 21-36), the number of times a customer is visited by small drones is found for each scenario based on the solution of the model and then the unsatisfied demand of all gathering points and the total unsatisfied demand of each scenario are calculated.

Table B7 presents the average total unsatisfied demand in terms of weight and number of people when the time bound is set as 30, 60, 90 and 120 min and lists the percentage changes in the total unsatisfied demand with respect to the original case, in which the time bound is 60 min in the columns “Change”. Experiments are conducted over ten different scenario sets with two different values of the number of depots, two different values of the number of launch points, three different values of the number of large drones, and one value of the number of small drones per launch point.

The original capacity of a small drone is set as 2 kg, and Table B8 compares the average results obtained by increasing the small drone capacity to 3, 4, and 5 kg over ten different scenario sets with two different values for the number of depots, two different values for the number of launch points, three different values for the number of large drones, one value for the number of small drones per launch point, and two different values for the time-bound.

Algorithm 1 Clustering approach

initialize: $C_s \leftarrow C, C^i \leftarrow \emptyset, C_s^{BD} \leftarrow \emptyset, t_l^{min} \leftarrow +\infty, n_{cs} \leftarrow 0, unsdemand_{cs} \leftarrow 0, totalunsdemand_s \leftarrow 0$

pre-processing:
eliminate inaccessible gathering points
calculate the minimum distance between launch point $l \in L$ and the closest depot and assign to t_l^{min}
for $c \in C$ **do**
  for $l \in L$ **do**
    if $t_{cl} + t_l^{min} > T$ **then**
      $C_s \leftarrow C_s \backslash \{c\}$
      $C^i \leftarrow C^i \cup \{c\}$
    end if
  end for
end for
for $s = 1$ to $|S|$ **do**
  assign gathering points with highest demand to large drones
  if $m^{BD} > 0$ **then**
    find the gathering points with first m^{BD} highest demand value for scenario s and assign those points to the set C_s^{BD}
  end if
  clustering:
  apply the k-means algorithm to customer set C_s and generate the set of clusters G and the set of customers C_g in cluster $g \in G$
  calculate the following parameters: $\psi_{lg} = \sum_{h \in C_g} t_{lh}$, $\sigma_{gs} = \sum_{h \in C_g} \xi_{hs}$, $\chi_{gs} = \max_{\{h \in C_g\}} \xi_{hs}$
  solve the model: Minimize (24) subject to (3)–(6), (13)–(15), (16′), (18′), (25)–(29)
  post-processing:
  calculate the number of times cluster $g \in G$ is visited in scenario s using the optimal values of z_{lgus}
  calculate the number of times customer $c \in C_s$ is visited in scenario s using the set of customers C_g in clusters $g \in G$ and assign it to n_{cs}
  for $c \in C$ **do**
    if $c \in C_s$ **then**
      $unsdemand_{cs} \leftarrow \max\{0, \xi_{cs} - n_{cs} Q_{SD}\}$
    else if $c \in C^i$ **then**
      $unsdemand_{cs} \leftarrow \xi_{cs}$
    else if $c \in C^{BD}$ **then**
      $unsdemand_{cs} \leftarrow \max\{0, \xi_{cs} - Q_{BD}\}$
    end if
  end for
  for $c \in C$ **do**
    $totalunsdemand_s \leftarrow totalunsdemand_s + unsdemand_{cs}$
  end for
  report $totalunsdemand_s$
end for

Table B7: Impact of the time bound

p	e	m^{BD}	$\lvert U \rvert$	30 min Uns. Demand (kg)	30 min People	30 min Change (%)	60 min Uns. Demand (kg)	60 min People	90 min Uns. Demand (kg)	90 min People	90 min Change (%)	120 min Uns. Demand (kg)	120 min People	120 min Change (%)
1	2	0	2	337.82	675637	6.38	317.55	635101	296.33	592653	-6.68	277.32	554643	-12.67
1	2	1	2	334.67	669336	6.30	314.83	629657	293.64	587276	-6.73	274.74	549477	-12.73
1	2	2	2	331.63	663262	5.81	313.41	626822	292.53	585070	-6.66	273.69	547382	-12.67
1	3	0	2	339.60	679207	11.74	303.92	607843	274.74	549479	-9.60	248.88	497764	-18.11
1	3	1	2	336.45	672908	11.71	301.19	602384	272.06	544119	-9.67	246.24	492476	-18.25
1	3	2	2	333.42	666834	11.22	299.77	599538	271.07	542144	-9.57	245.14	490287	-18.22
2	2	0	2	337.06	674117	7.42	313.78	627566	292.94	585884	-6.64	276.79	553583	-11.79
2	2	1	2	333.91	667817	7.32	311.14	622282	290.25	580497	-6.71	274.16	548314	-11.89
2	2	2	2	330.87	661743	6.81	309.78	619564	289.00	578008	-6.71	273.19	546384	-11.81
2	3	0	2	332.20	664393	12.42	295.51	591014	270.43	540865	-8.49	244.87	489732	-17.14
2	3	1	2	329.05	658096	12.36	292.86	585722	267.83	535669	-8.55	242.26	484518	-17.28
2	3	2	2	326.01	652020	11.85	291.47	582940	266.68	533356	-8.51	241.19	482385	-17.25
Average				333.56	667114.22	9.28	305.43	610869.43	281.46	562918.29	-7.88	259.87	519745.47	-14.98
Minimum				326.01	652020.18	5.81	291.47	582939.92	266.68	533356.27	-6.64	241.19	482385.47	-11.79
Maximum				339.60	679207.22	12.42	317.55	635101.08	296.33	592652.89	-9.67	277.32	554642.79	-18.25

Table B8: Impact of the small drone capacity

p	e	m^{BD}	$\|U\|$	T (h)	2kg Uns. Demand (kg)	2kg People	3kg Uns. Demand (kg)	3kg People	3kg Change (%)	4kg Uns. Demand (kg)	4kg People	4kg Change (%)	5kg Uns. Demand (kg)	5kg People	5kg Change (%)
1	2	0	2	1	317.55	635101	312.98	625955	-1.44	310.26	620522	-2.30	308.97	617935	-2.70
1	2	1	2	1	314.83	629657	310.36	620723	-1.42	307.73	615463	-2.25	306.48	612964	-2.65
1	2	2	2	1	313.41	626822	309.60	619193	-1.22	307.23	614456	-1.97	305.99	611983	-2.37
1	3	0	2	1	303.92	607843	297.60	595207	-2.08	293.86	587711	-3.31	291.65	583305	-4.04
1	3	1	2	1	301.19	602384	295.00	590005	-2.06	291.31	582615	-3.28	289.13	578265	-4.00
1	3	2	2	1	299.77	599538	294.24	588486	-1.84	290.79	581579	-3.00	288.60	577204	-3.73
2	2	0	2	1	313.78	627566	306.66	613320	-2.27	303.51	607018	-3.27	301.98	603955	-3.76
2	2	1	2	1	311.14	622282	304.16	608326	-2.24	301.13	602257	-3.22	299.57	599136	-3.72
2	2	2	2	1	309.78	619564	303.35	606690	-2.08	300.34	600684	-3.05	298.81	597620	-3.54
2	3	0	2	1	295.51	591014	289.19	578382	-2.14	286.36	572715	-3.10	284.41	568829	-3.75
2	3	1	2	1	292.86	585722	286.73	573457	-2.09	284.00	567999	-3.03	282.02	564049	-3.70
2	3	2	2	1	291.47	582940	285.70	571402	-1.98	282.96	565913	-2.92	281.02	562048	-3.58
1	2	0	2	2	277.32	554643	271.72	543435	-2.02	268.95	537897	-3.02	266.93	533867	-3.75
1	2	1	2	2	274.74	549477	269.28	538550	-1.99	266.58	533153	-2.97	264.76	529518	-3.63
1	2	2	2	2	273.69	547382	268.49	536971	-1.90	266.19	532375	-2.74	264.40	528803	-3.39
1	3	0	2	2	248.88	497764	239.28	478563	-3.86	229.92	459843	-7.62	226.89	453772	-8.84
1	3	1	2	2	246.24	492476	236.83	473662	-3.82	227.40	454798	-7.65	224.53	449051	-8.82
1	3	2	2	2	245.14	490287	236.10	472197	-3.69	227.94	455876	-7.02	224.34	448683	-8.49
2	2	0	2	2	276.79	553583	267.52	535041	-3.35	263.50	527002	-4.80	261.33	522654	-5.59
2	2	1	2	2	274.16	548314	265.12	530234	-3.30	261.21	522416	-4.72	258.93	517869	-5.55
2	2	2	2	2	273.19	546384	264.38	528753	-3.23	260.84	521687	-4.52	258.76	517510	-5.28
2	3	0	2	2	244.87	489732	235.27	470543	-3.92	230.55	461110	-5.84	227.62	455235	-7.04
2	3	1	2	2	242.26	484518	232.78	465558	-3.91	228.19	456388	-5.81	225.47	450943	-6.93
2	3	2	2	2	241.19	482385	232.35	464690	-3.67	227.84	455684	-5.54	225.26	450524	-6.60
Average					282.65	565307.45	275.61	551222.56	-2.56	271.61	543214.93	-4.04	269.49	538988.41	-4.81
Minimum					241.19	482385.47	232.35	464690.03	-1.22	227.40	454797.87	-1.97	224.34	448683.20	-2.37
Maximum					317.55	635101.08	312.98	625954.72	-3.92	310.26	620521.53	-7.65	308.97	617934.56	-8.84

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