

Algorytmy i struktury danych - Lista 4

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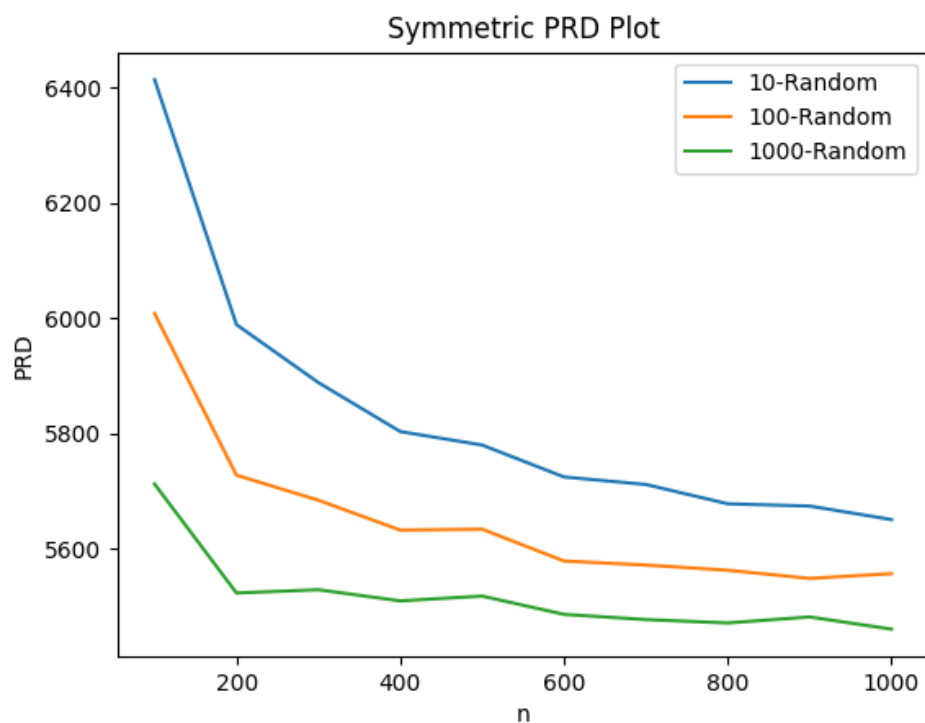
31 marca 2022

1 Algorytm k-random

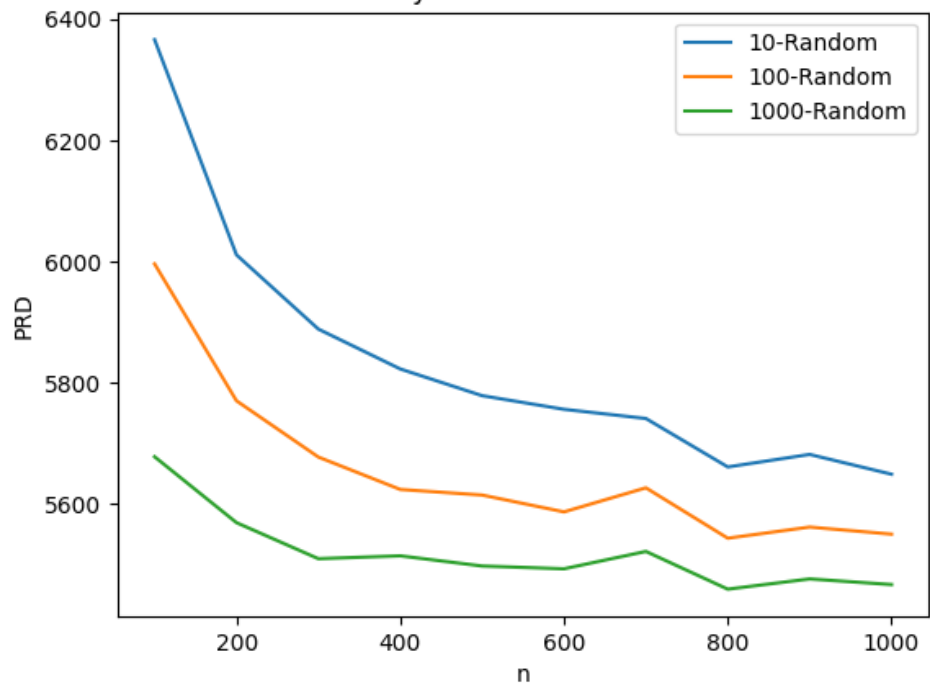
1.1 Tabela

Average PRD			
n	10-Random	100-Random	1000-Random
100	6413.9156401721075	6007.918586928952	5711.806977951733
200	5988.615372379403	5727.247304868426	5522.69171607988
300	5888.036831784668	5683.792028830031	5528.337270981829
400	5802.963142088209	5631.843379656301	5508.994282851
500	5779.552537965469	5633.505579085746	5517.331574583659
600	5724.137341197624	5578.206097637371	5485.583014224162
700	5711.069467439124	5571.201094319976	5476.566562989776
800	5677.560472641102	5562.185079759854	5470.719995332991
900	5673.623396583947	5548.007479574144	5481.1123195262335
1000	5650.144622314967	5556.232385763668	5459.875331845722

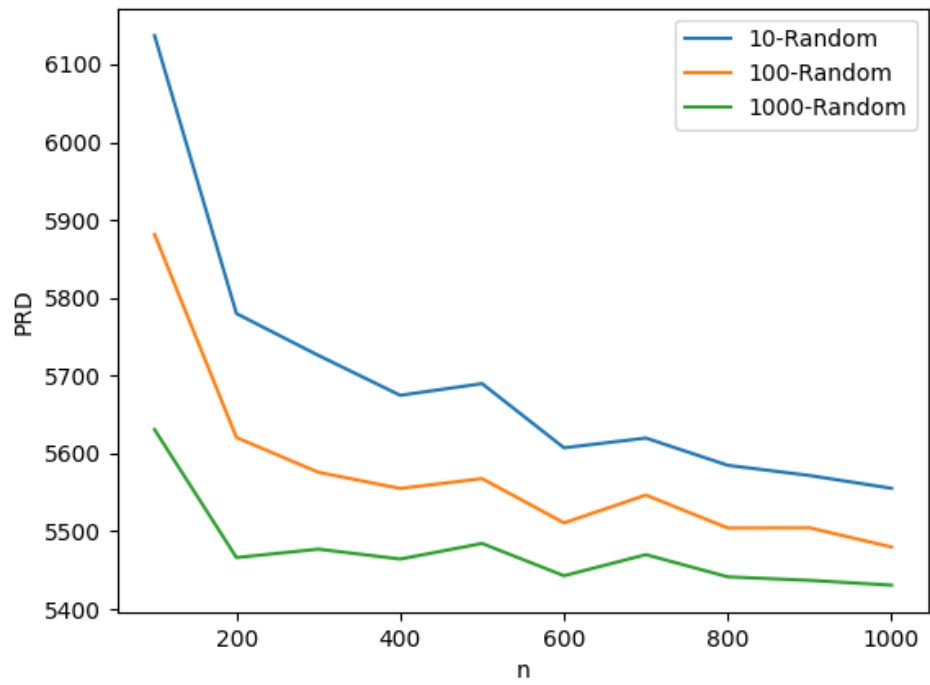
1.2 Wykresy



Asymmetric PRD Plot



Euclid PRD Plot



2 Porównanie algorytmów na grafach euklidesowych z TSPLIB

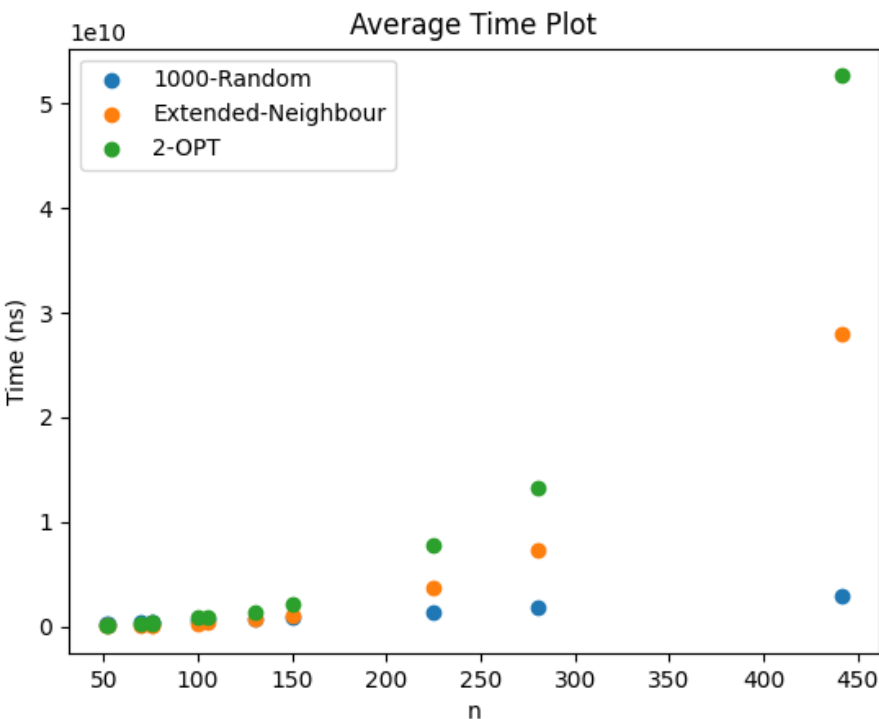
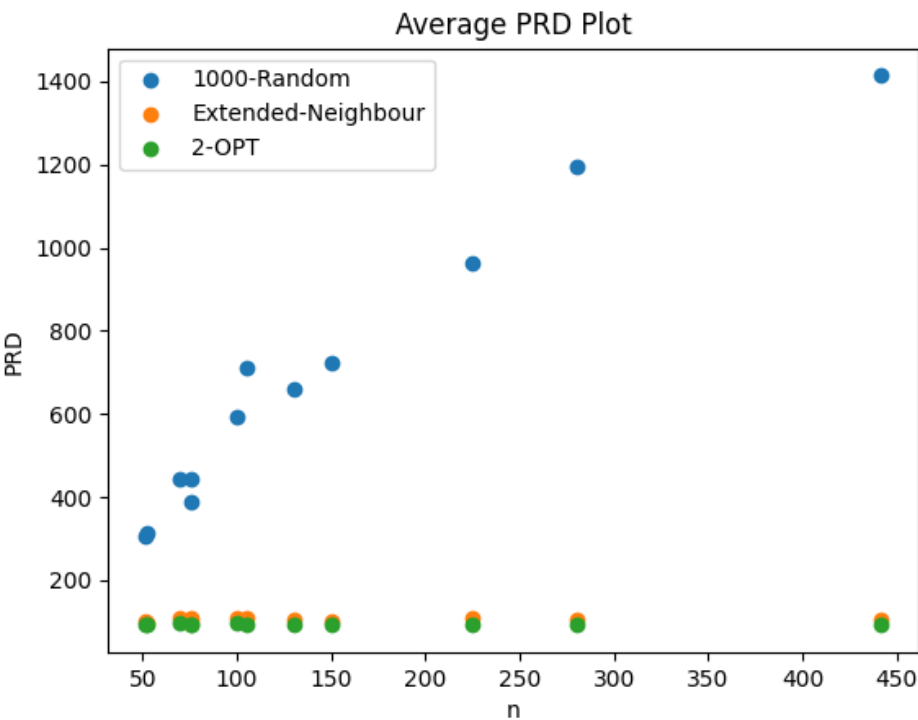
2.1 Tabele

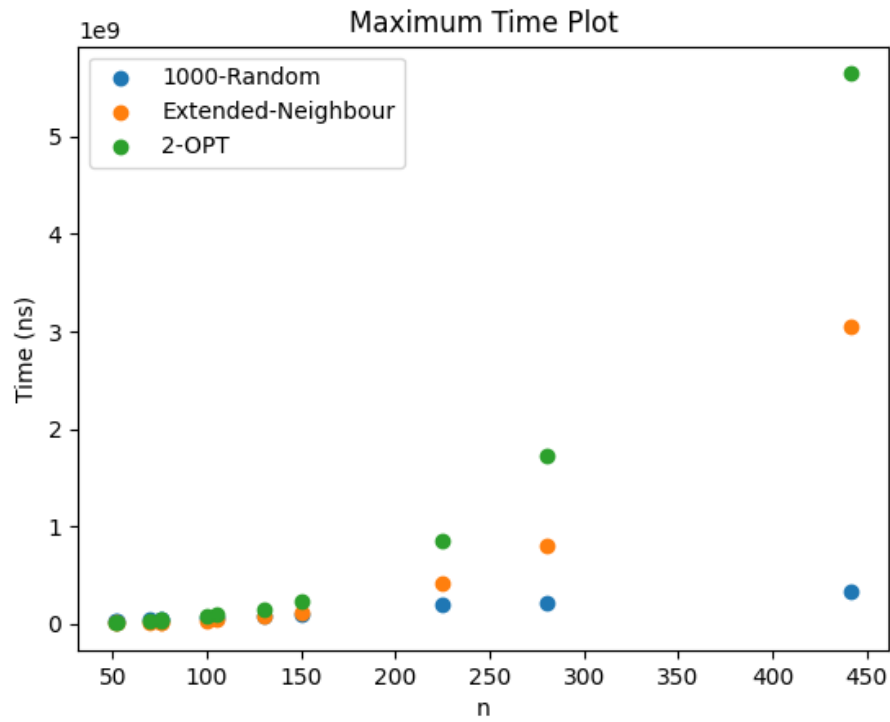
Average PRD			
n	1000-Random	Extended-Neighbours	2-OPT
280	1190.481	105.355	94.110
52	313.842	98.473	92.241
130	655.514	105.463	93.669
150	722.093	100.510	91.808
51	304.930	103.146	91.878
76	390.223	103.011	92.974
105	719.383	107.776	95.285
442	1410.979	106.094	94.210
76	437.657	111.045	94.849
100	599.637	109.201	95.515
70	443.081	107.926	97.704
225	958.394	110.576	94.255

Average Time			
n	1000-Random	Extended-Neighbours	2-OPT
280	1824391000	7216115200	12956555100
52	337466300	53224900	100680300
130	847446300	776220800	1495083700
150	1216246900	1413185300	2831431300
51	397964700	70906500	135488700
76	529495400	169370500	342460800
105	826099200	562516800	1193324400
442	2925433800	28520444700	53773197200
76	451942500	153868400	348626900
100	599398700	332370900	876795000
70	435804700	123948500	285729600
225	1336604800	3619145800	7337685000

Maximal Time			
n	1000-Random	Extended-Neighbours	2-OPT
280	226062700	800549100	1374390600
52	36579000	5832400	11066200
130	103836900	84908600	173113200
150	196152300	201122200	433930400
51	52224600	11076500	18398300
76	66321000	20809800	38979800
105	103035700	73946000	164836700
442	330026000	3123459200	5680294300
76	45770600	15989400	35452500
100	61684700	34254200	90924800
70	50222300	15401600	34864000
225	137559000	367219200	757268500

2.2 Wykresy





3 Porównanie algorytmów na grafach generowanych losowo

3.1 Tabele

3.1.1 Grafy asymetryczne

n	Average Time			
	1000-Random	Neighbours	Extended-Neighbours	2-OPT
100	5215583333	28571666	2786506666	3001888333
200	10385900000	102848333	20872141666	21460786666
300	15575736666	230665000	69467785000	71687228333
400	20725138333	400460000	161340206666	164356600000
500	25681436666	630796666	312382090000	319592263333
600	31847411666	893138333	539254811666	546289266666
700	37347566666	1216818333	852635371666	864857386666
800	43085846666	1589101666	1276754056666	1285017576666
900	48517803333	2017996666	1807960408333	1825393600000
1000	53376455000	2458155000	2488077001666	2527648053333

Maximum Time				
n	1000-Random	Neighbours	Extended-Neighbours	2-OPT
100	53740500	296200	28250900	31605000
200	110770900	1068300	222382100	217436400
300	156366900	2430200	699352300	730365300
400	218396100	4173300	1630130200	1658699700
500	272075700	6445900	3154009300	3248476300
600	326146900	9109900	5445648700	5518205200
700	392337400	12303600	8644185800	8705532900
800	442730100	16022200	12919136400	12989845300
900	497044800	20912700	18259475600	18320587400
1000	545819300	25097700	25367610900	26443099700

Average PRD				
n	1000-Random	Neighbours	Extended-Neighbours	2-OPT
100	144389.48040576265	5323.792664503988	19.841269841269842	0
200	264424.58297728904	5207.564744303786	0	0
300	344372.7648431962	5095.76765521116	99.36766034327009	0
400	454295.2612852427	5024.999051480909	0	0
500	542028.8049036451	3589.213599432774	103.10202617894926	0
600	699247.4253613068	4932.616806843915	0	0
700	755741.8205443585	4089.52732594919	0	0
800	808528.5198217536	4024.938451458384	0	0
900	926564.7954870298	4759.48286220438	0	0
1000	1000638.9406083454	3671.7679495233406	0	0

3.1.2 Grafy symetryczne

Average Time				
n	1000-Random	Neighbours	Extended-Neighbours	2-OPT
100	5118872000	27634000	2761260000	4705872000
200	10426454000	110419000	20948980000	33434436000
300	15504584000	235028000	69605889000	109212242000
400	20687462000	405624000	162160400000	246114934000
500	25238599000	626720000	315572915000	464210183000
600	33565792000	908487000	552476749000	793604803000
700	40401877000	1304289000	891778583000	1298559476000
800	44722603000	1664659000	1291840090000	1848839045000
900	48923905000	2028359000	1834605650000	2642838875000
1000	53613716000	2543461000	2531951057000	3497862690000

Maximum Time				
100	53478300	287700	28774700	59023500
200	118932100	1496800	225860300	374150100
300	158825400	2666500	713698900	1210248700
400	214809200	4154100	1651365900	2783661100
500	259651300	6437400	3196615100	4989667500
600	369051000	9376100	5731537000	8662696500
700	453044000	15011700	9255213200	14112162500
800	519034200	18486000	13176742300	20361935900
900	542197200	21026000	18626545300	27632920000
1000	587381000	28130500	26359530800	38144374100

Average PRD				
n	1000-Random	Neighbours	Extended-Neighbours	2-OPT
100	169641.5152490044	8651.420983070748	2910.828178233857	0
200	336491.148021938	8695.594682621479	3759.5914230406697	0
300	467506.6707100455	9672.03524228703	3958.851600018442	0
400	626451.037540901	9242.735074436148	4352.368040212525	0
500	762030.9959416362	9491.651021903159	3688.834144036091	0
600	907750.4576801556	10564.279122298864	3896.5508009869172	0
700	999294.050859801	10511.632970306257	4405.698984443974	0
800	1177366.205236822	10932.69827564215	4323.395735797874	0
900	1312890.7423081866	9844.799687300712	4385.352415182208	0
1000	1445342.3876189813	9645.3501317382	4554.947937370816	0

3.1.3 Grafy euklidesowe

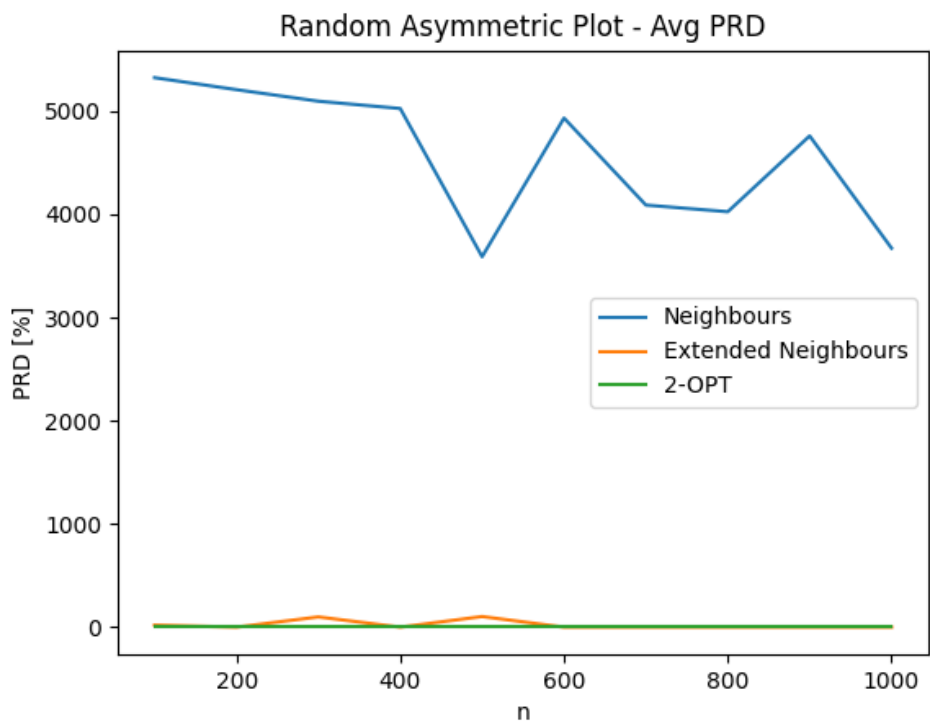
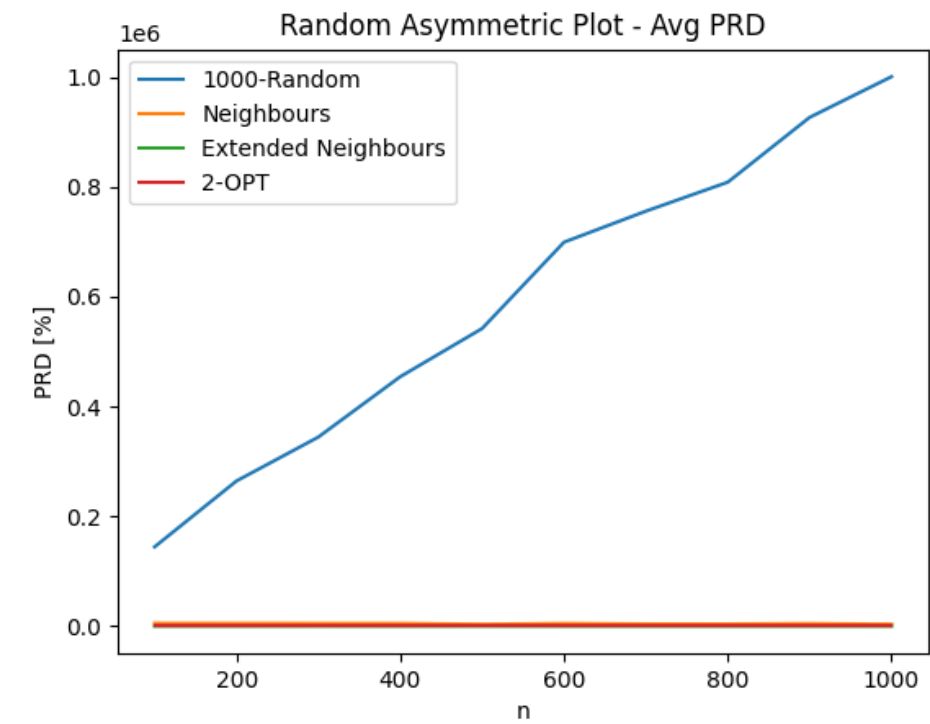
Average Time				
n	1000-Random	Neighbours	Extended-Neighbours	2-OPT
100	5430231666	29933333	2909718333	5610398333
200	11033958333	108678333	22288358333	47841571666
300	15708336666	238925000	71815146666	149125501666
400	21969775000	420680000	168567516666	340063338333
500	26306493333	644906666	327083776666	689031216666
600	33492466666	941325000	568170671666	1224798638333
700	40003946666	1280896666	907097273333	1902227616666
800	46368281666	1705881666	1352010363333	2914841420000
900	49810670000	2115170000	1857726728333	3970601576666
1000	53497760000	2547503333	2548862593333	5568105215000

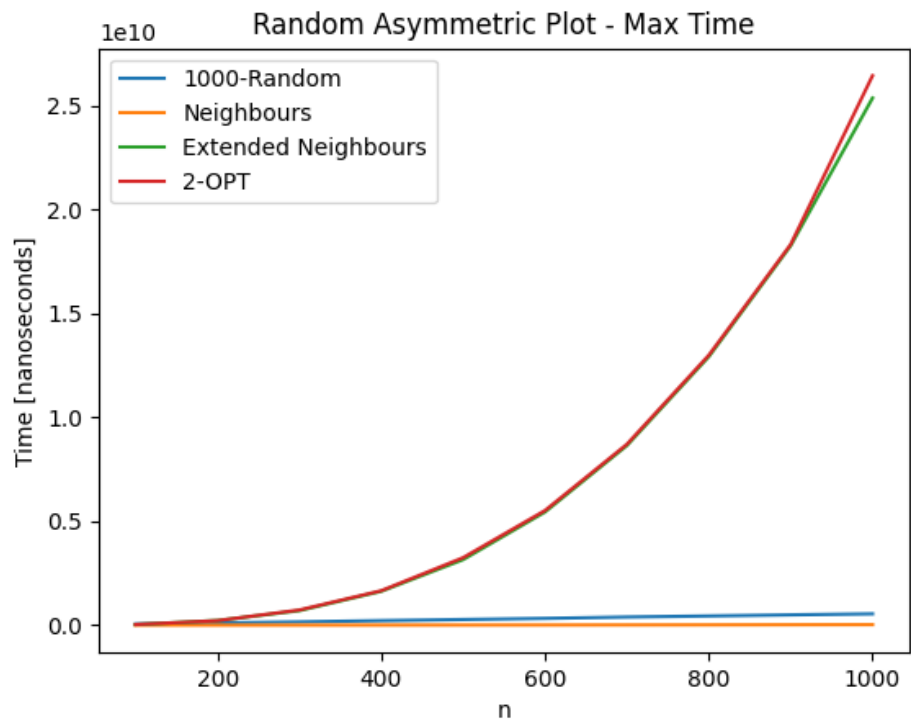
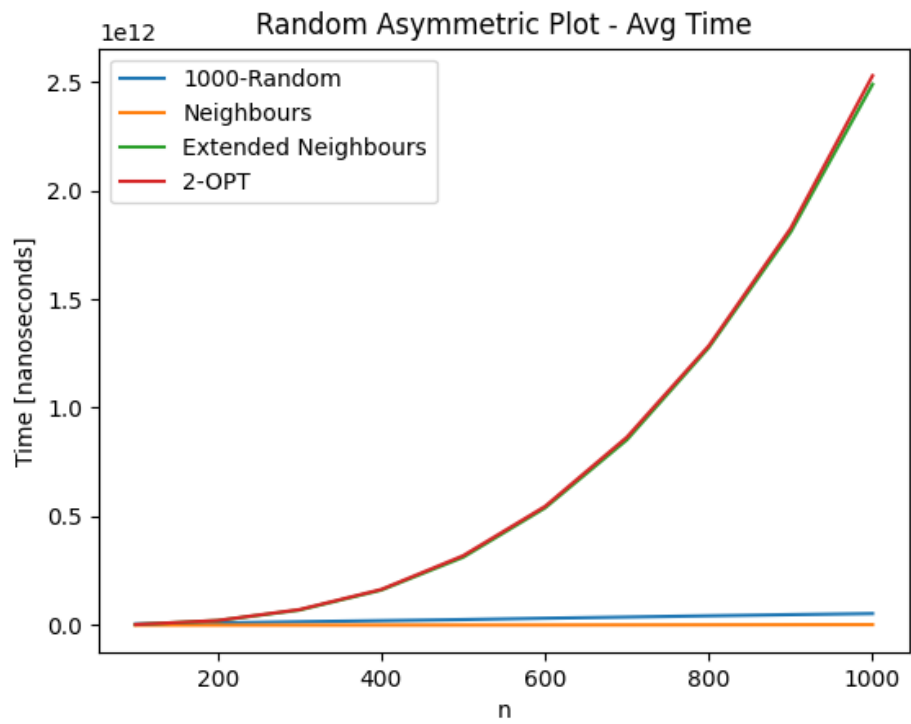
Maximum Time				
100	56904000	321200	30141400	66528500
200	113894700	1158400	234500000	519662900
300	164992700	2442400	726804400	1549853100
400	232275800	4327000	1701320800	3590054900
500	286456400	6665100	3415103000	7359945700
600	349887600	9601400	5758347300	13165101000
700	426304400	13348700	9258026500	20301730000
800	485403100	18255900	13873937600	31742944800
900	510576800	21615300	18716893000	41209877500
1000	555995400	26168200	25734825600	57516775300

Average PRD				
n	1000-Random	Neighbours	Extended-Neighbours	2-OPT
100	45057.17215979038	2590.834778478913	1152.047375520498	0
200	75024.50161461842	2064.382965833475	1126.787169849889	0
300	95586.47736955529	2089.941890785232	1319.4679540953857	0
400	115379.31540464885	1936.2643602499013	1170.3148715360107	0
500	129969.40868945165	1916.510105455013	1432.3355018206873	0
600	147132.99203529008	1877.0634799785885	1325.9108020407148	0
700	158377.07578069592	1780.3974674441433	1334.865053976823	0
800	173366.5990915691	2018.4858325151736	1443.038050374855	0
900	184435.2199324318	1859.5850439135654	1345.825159240164	0
1000	197381.2850131005	2066.702637095026	1479.7361632179882	0

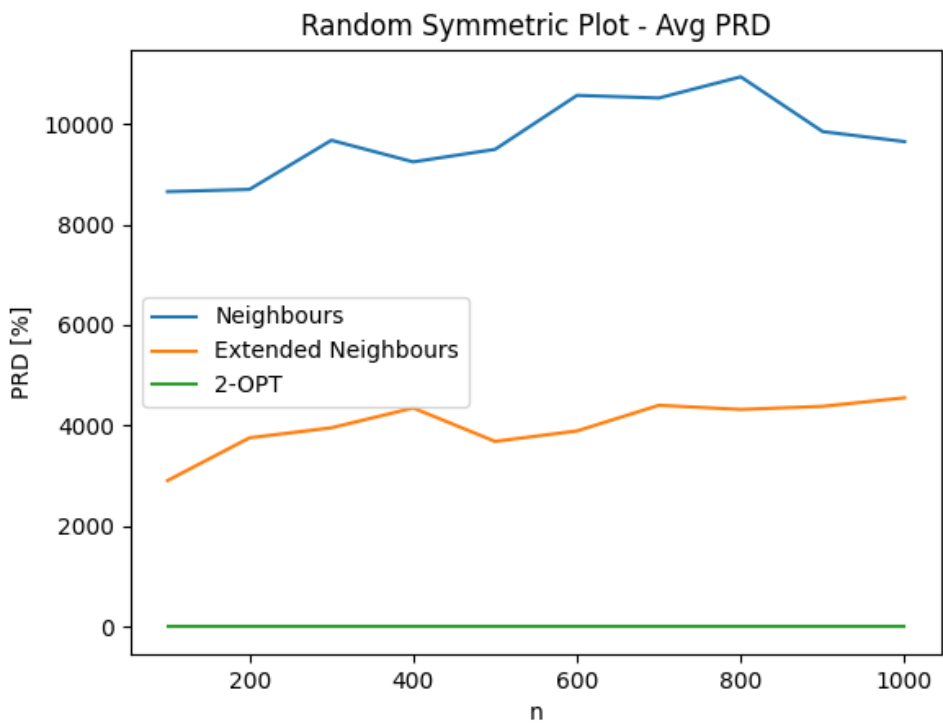
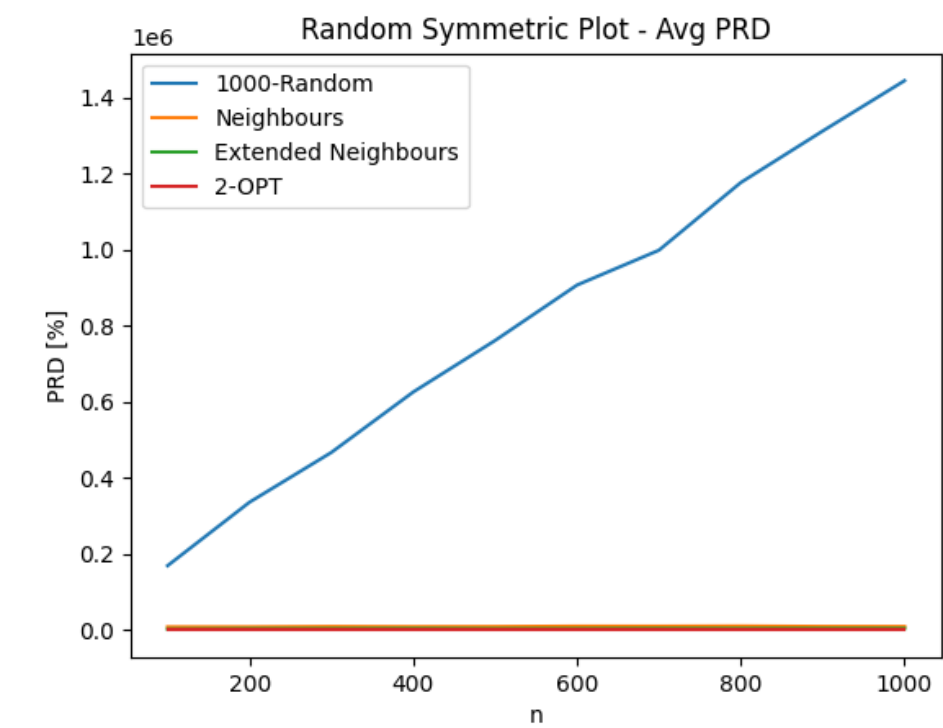
3.2 Wykresy

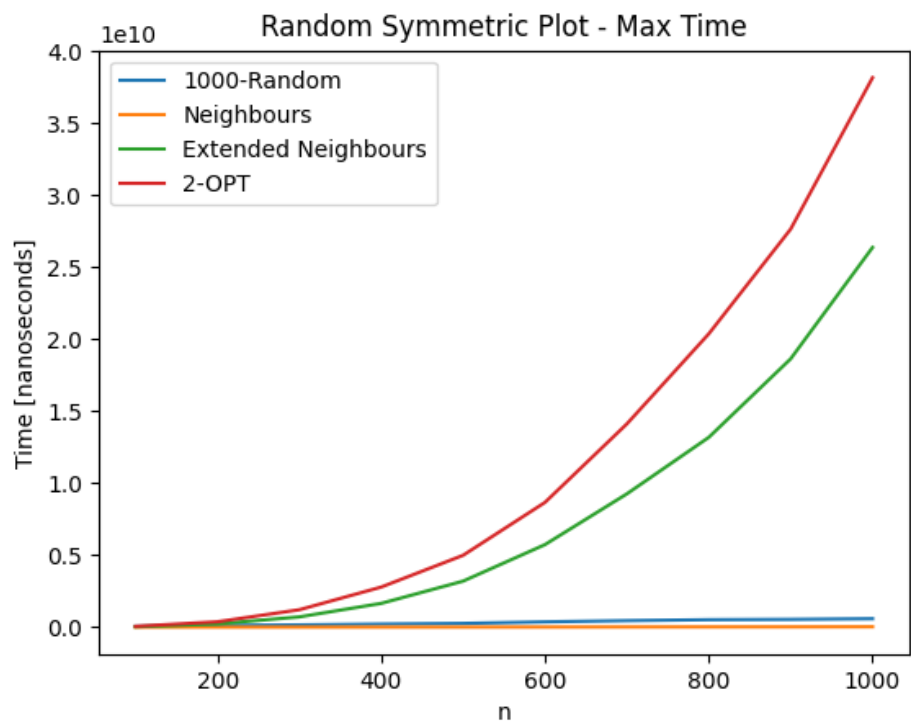
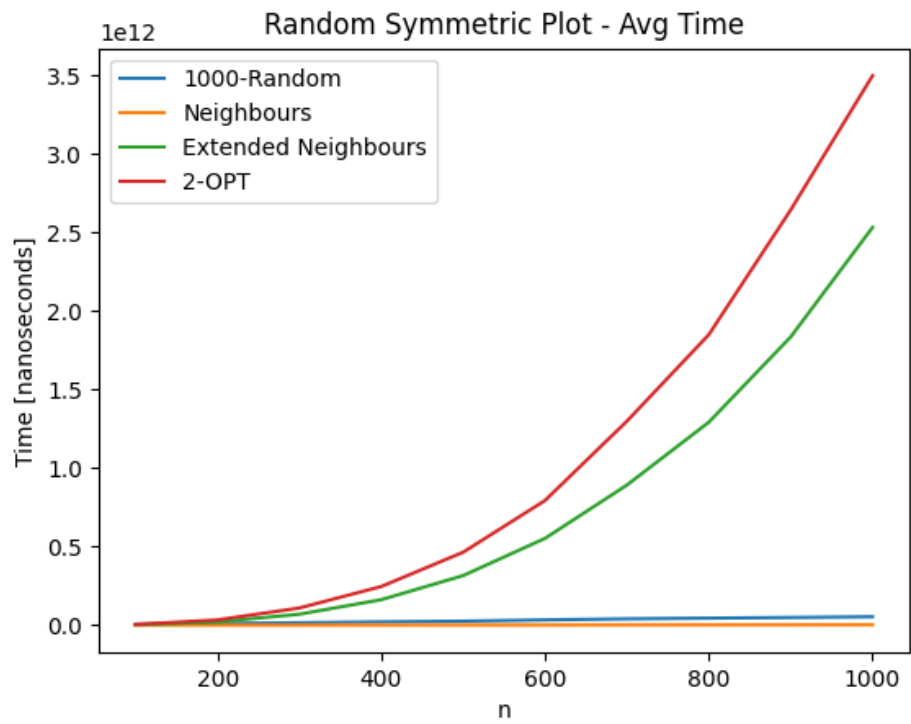
3.2.1 Grafy asymetryczne



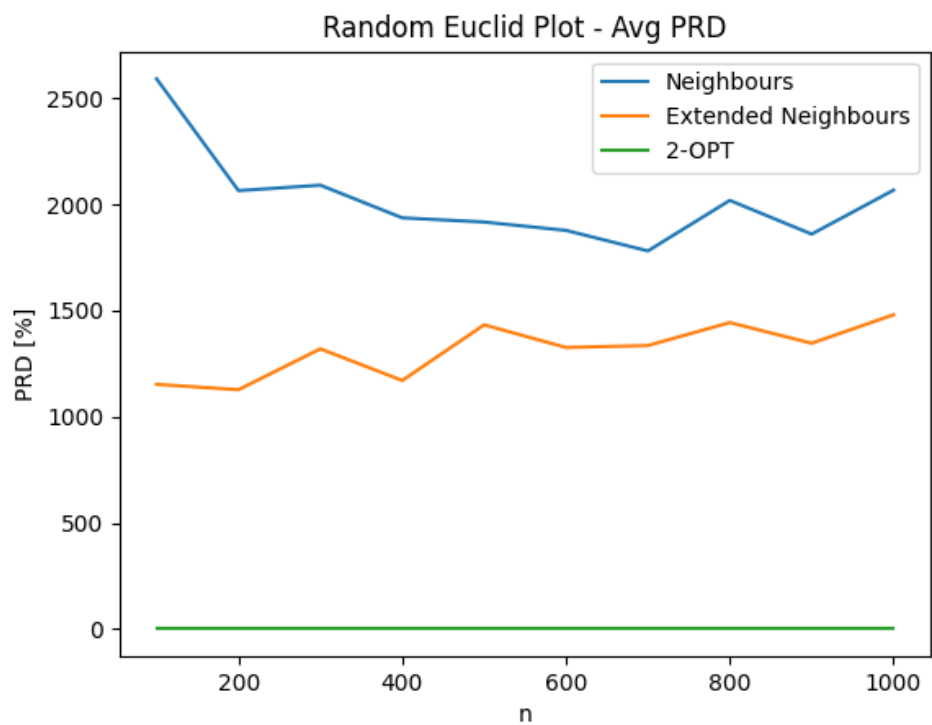
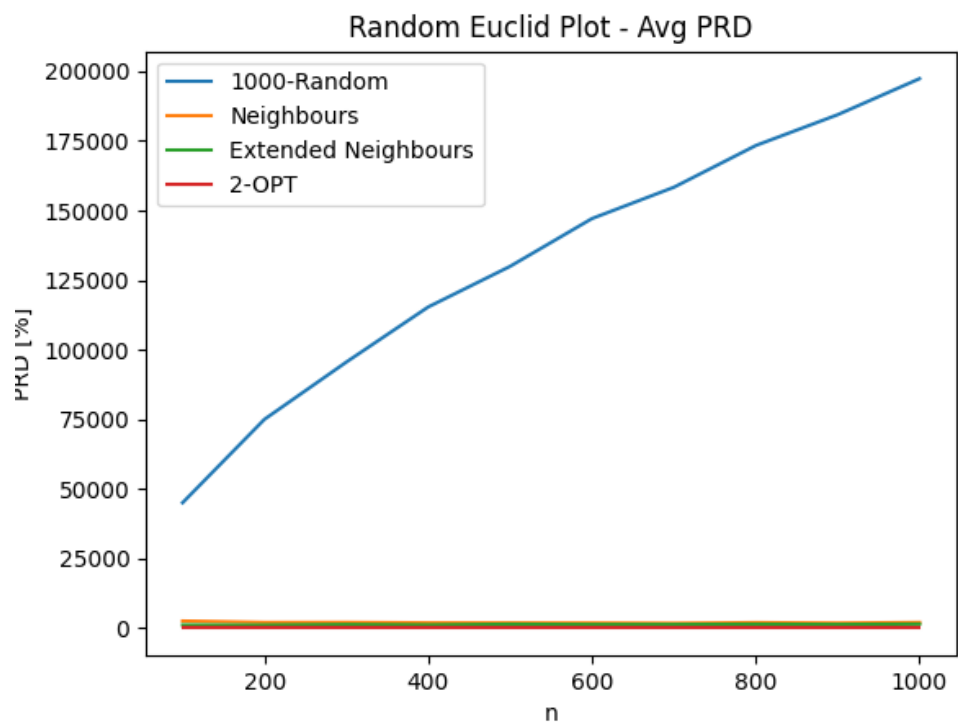


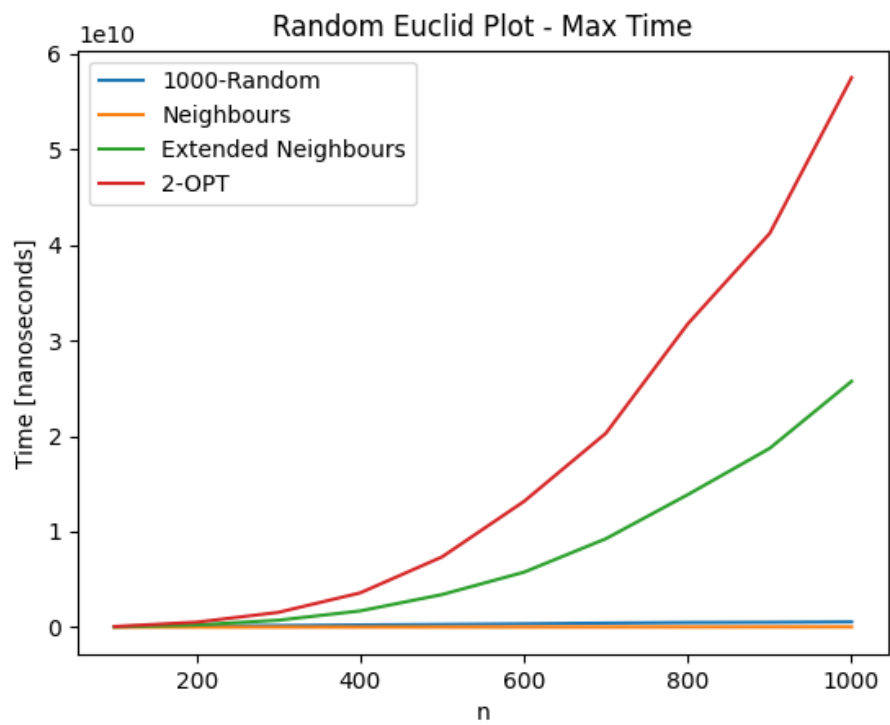
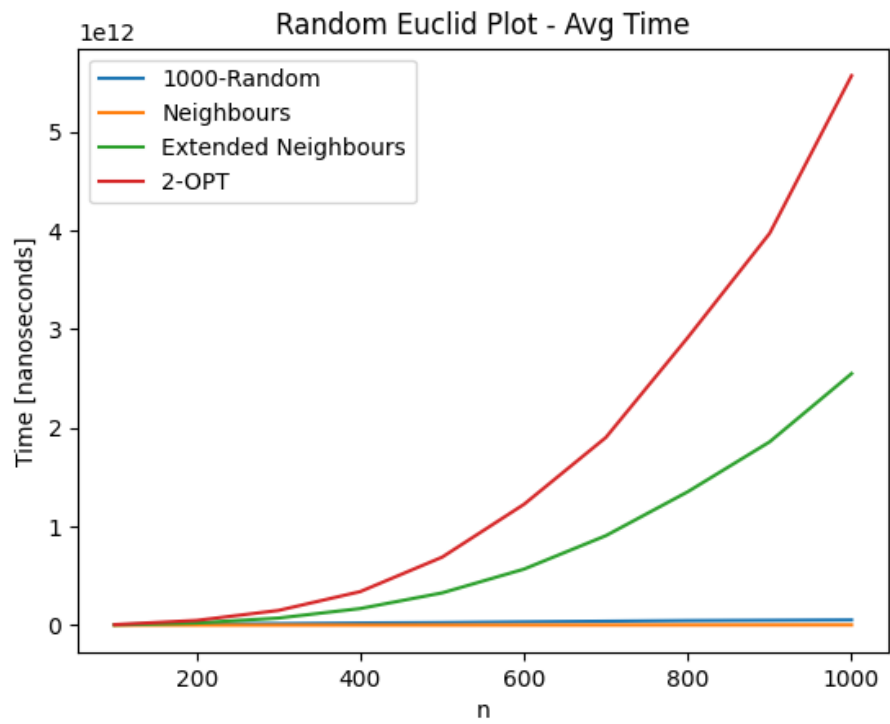
3.2.2 Grafy symetryczne





3.2.3 Grafy euklidesowe





3.3 Wnioski

4 Porównanie 2-OPT w zależności od przybliżenia początkowego

4.1 Tabele

4.1.1 Grafy asymetryczne

Asymmetric Graphs with 2-OPT						
	AVG Time		MAX Time		AVG PRD	
n	1000-Random	Ext-Neighbours	1000-Random	Ext-Neighbours	1000-Random	Ext-Neighbours
50	48453200	6136500	3738398333	489811666	35597.04376268311	0
100	140853600	35301100	11970911666	3169770000	73004.9758129217	0
150	337295400	98910400	29113163333	9698358333	96256.98438783734	0
200	643440000	222620100	58731895000	21984178333	119059.65961691776	0
250	1392918200	438522000	123776605000	43217630000	144661.62881606517	0
300	1981728700	744836600	181790746666	72750526666	168466.84457767615	0
350	3127470800	1156490900	294949878333	114528933333	201839.59192018144	0
400	4895469300	1719545200	434607098333	170149210000	219001.69640333427	0
450	6997186800	2429447700	638500593333	241024308333	231538.9713570598	0
500	10230351100	3378707200	905001025000	331310758333	249834.60481496935	0

4.1.2 Grafy symetryczne

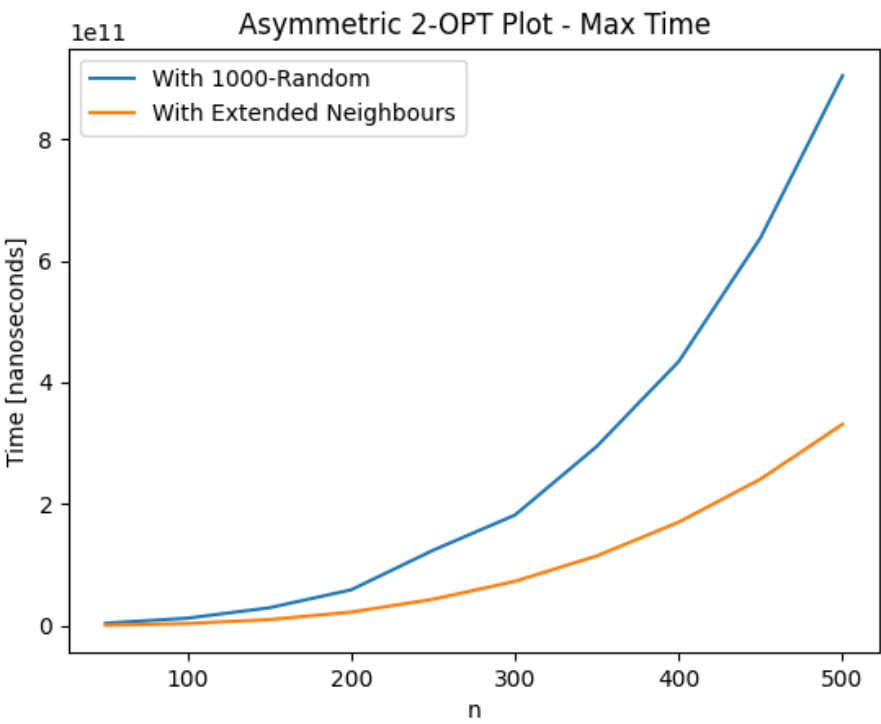
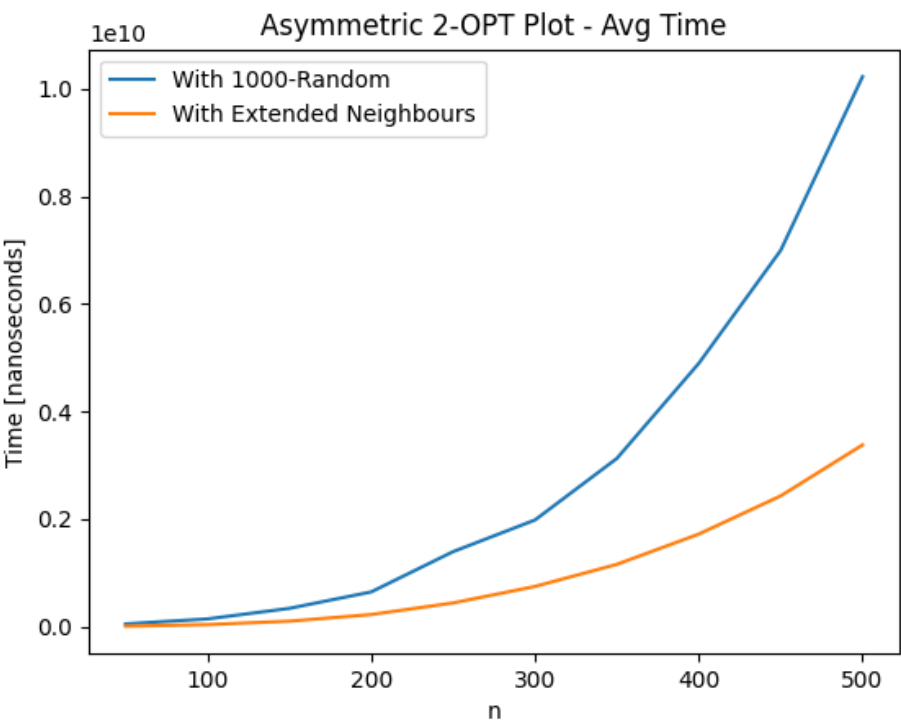
Symmetric Graphs with 2-OPT						
	AVG Time		MAX Time		AVG PRD	
n	1000-Random	Ext-Neighbours	1000-Random	Ext-Neighbours	1000-Random	Ext-Neighbours
50	54974700	8059300	4912670000	742475000	435.01603975448376	0
100	263593200	79644600	24933430000	6215445000	296.5871346219297	76.26814793409217
150	854941600	252056300	79812985000	21103678333	562.0643403667292	0
200	1974940700	463551300	190022033333	43272870000	386.77781639316737	0
250	3901226900	977426600	381697053333	91518833333	435.57918990772185	0
300	6813259300	1703896100	653903618333	152749565000	527.1451034832014	0
350	10818486000	2609217900	1042695165000	247398490000	371.06322593105233	0
400	15996929900	4046430100	1577727018333	354304303333	351.7245426245308	0
450	22753961100	5739451900	2246563521666	524977991666	510.1009193872297	0
500	31306288200	7293158000	3088863130000	682899385000	423.6764076969968	0

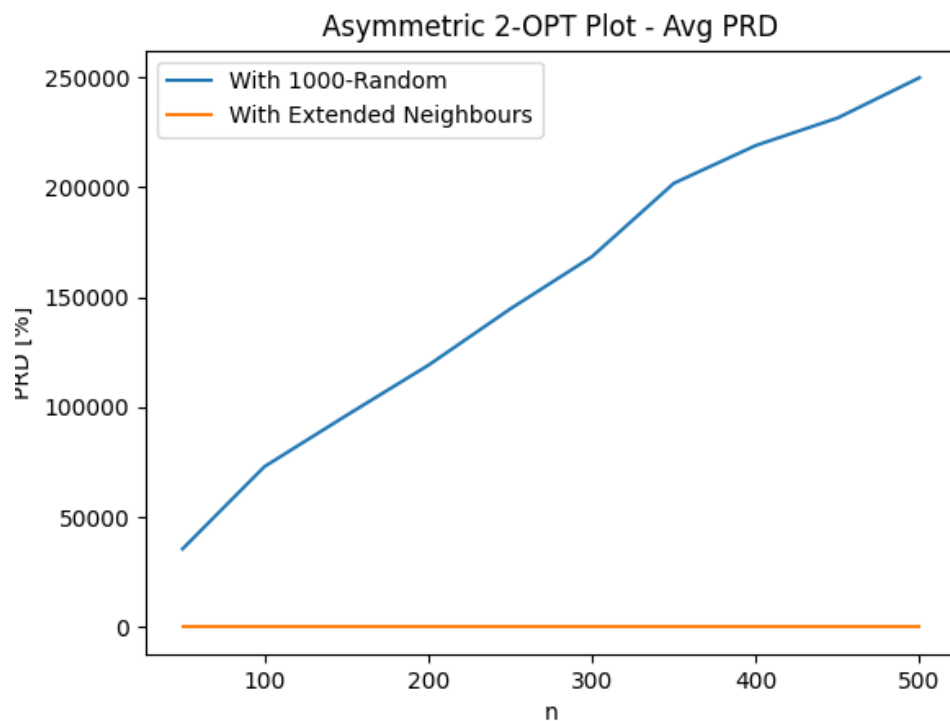
4.1.3 Grafy euklidesowe

Euclid Graphs with 2-OPT						
	AVG Time		MAX Time		AVG PRD	
n	1000-Random	Ext-Neighbours	1000-Random	Ext-Neighbours	1000-Random	Ext-Neighbours
50	50845700	7325400	4806420000	695278000	2596.308721025397	0
100	236384300	50275900	22503444000	4360152000	4683.4335972388535	0
150	748642900	159204100	71871182000	15081932000	4791.206250105386	0
200	1752181800	360983300	173144656000	33194196000	5703.476754080477	0
250	3597519600	719419300	336032994000	66473034000	6640.879179142622	0
300	6177012400	1247142900	584690090000	115264876000	8480.93216294145	0
350	9811912400	2034889600	950499916000	179479596000	8406.706667218925	0
400	14885090600	2743647200	1429223796000	263122394000	9456.626662228227	0
450	20679005000	3990645200	2027474658000	374963440000	10298.344279214956	0
500	30105890700	5752855600	2857272732000	527189884000	10733.905445781715	0

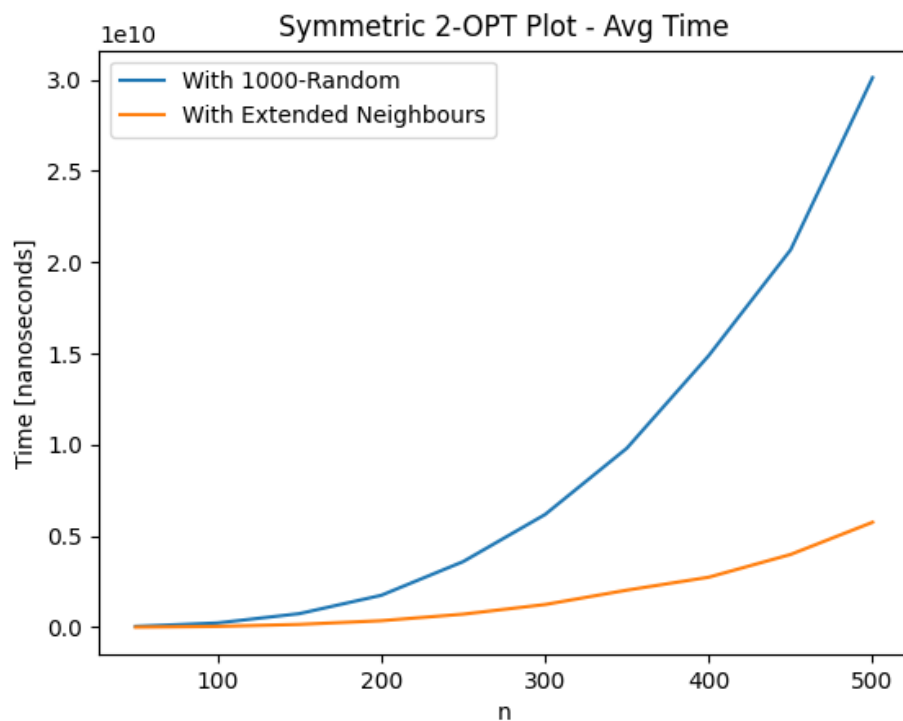
4.2 Wykresy

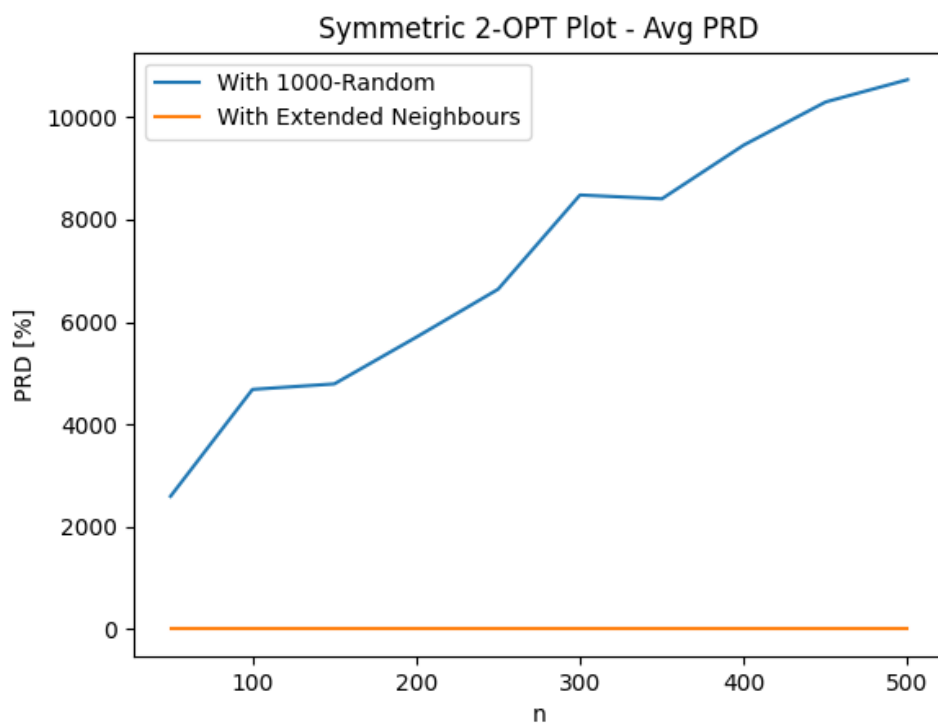
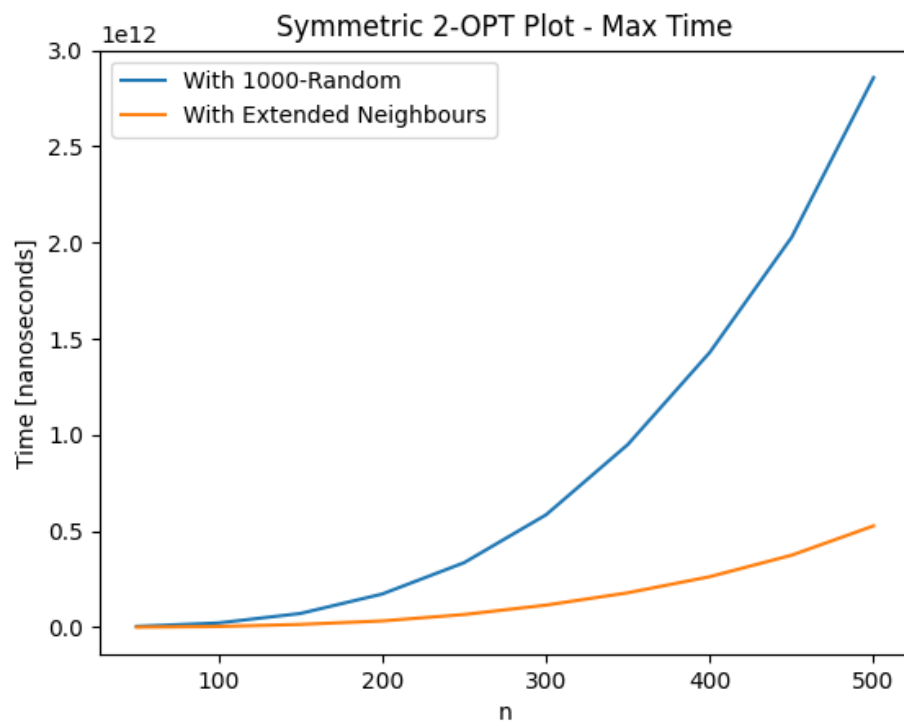
4.2.1 Grafy asymetryczne



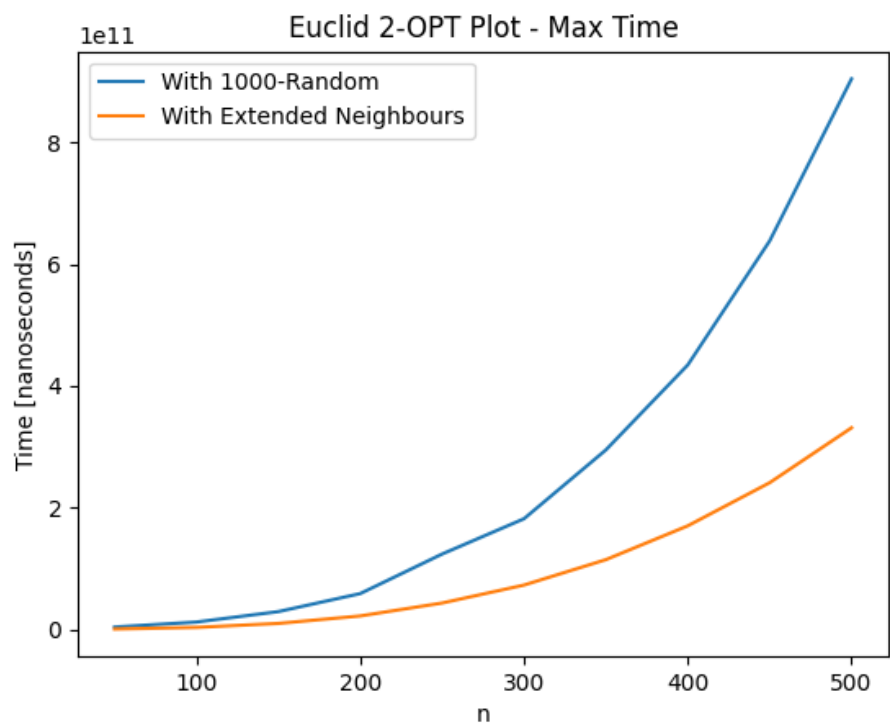
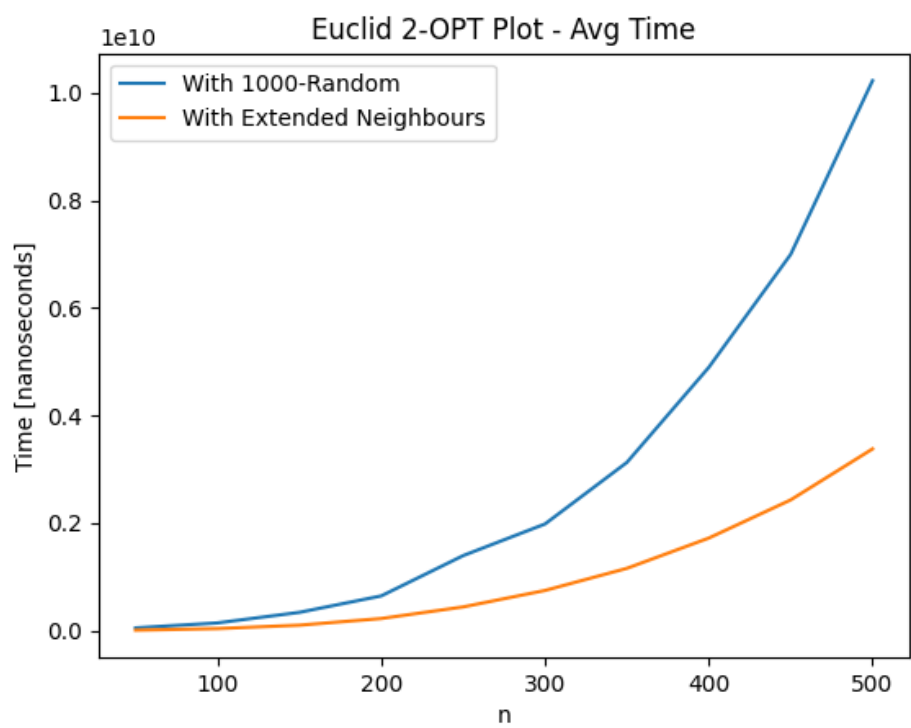


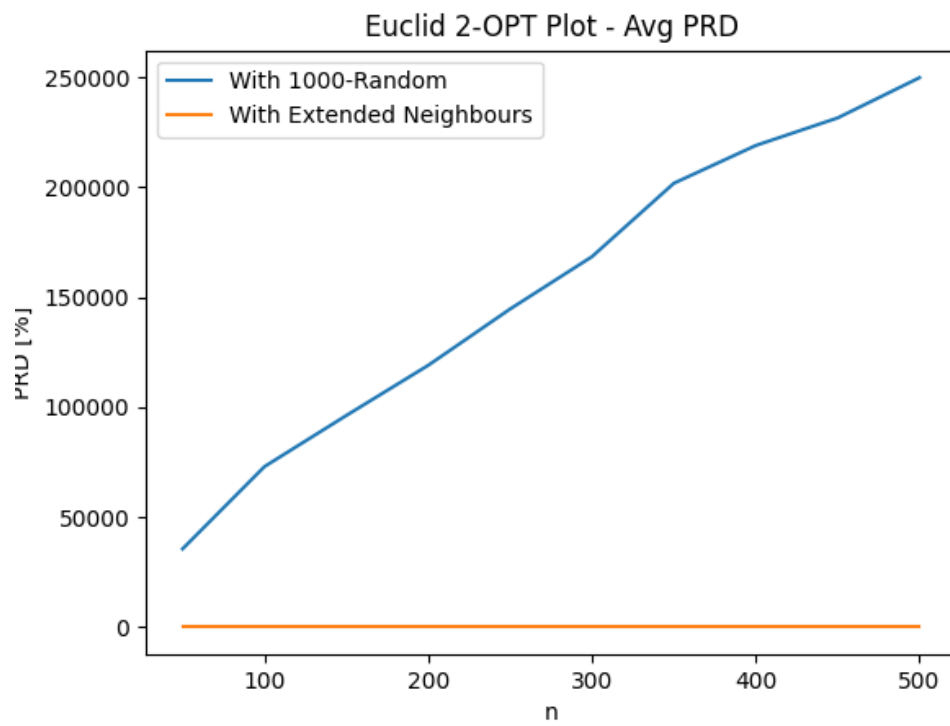
4.2.2 Grafy symetryczne





4.2.3 Grafy euklidesowe





4.3 Wnioski