COMP 304: Project 2 Spacecraft Control with Pthreads

Alp Özaslan - Onur Eren Arpacı https://github.com/alpozaslan/comp_304_project2.git

Part 1:

We created producer threads and queues for each job type, namely landing, launch, and assembly. We also created consumer threads and queues for PadA and PadB. Each queue has its own mutex. Lastly there is the ControlTower thread to control the flow.

Producer threads are sleeping 2 seconds, randomly creating a job or not according to their probability, enqueueing the job to their respective queue and they repeat it until the simulation ends.

Consumer queues are sleeping for the duration of the first job in their queue, then they dequeue the job and they repeat until the simulation ends.

ControlTower thread first dumps all the landing jobs to the PadAQueue and PadBQueue. It distributes them so that the pad with the smaller total duration left in their queue takes the next landing job. It then checks whether the PadA and PadB queues are empty meaning there are no landing jobs left to do, if so It puts an assembly job to the PadAQueue and a launch job to the PadBQueue. It repeats this process until the simulation ends.

There are also some helper functions:

WriteLog takes the job and the pad name, produces the log string and appends it to the log.txt PrintQueue takes a queue and prints the ids of the jobs from start to end.

PrintCurrentQueues prints the status of all the queues one by one

Part 2:

The suggested solution can cause starvation because after there are more than 3 ground jobs waiting, the landing jobs will lose their priority and if there are enough ground jobs incoming so that there are always some of them past their maximum wait time, the control tower will never take another landing job.

We decided to implement the following solution:

If there are less than 3 assembly jobs and less than 3 launch jobs waiting, then we use the same algorithm with part 1, otherwise the control tower pushes a single job to the pads for each job type. So it pushes a launch job to PadAQueue, an assembly job to PadBQueue and a landing job to whichever pad has the least total duration left.

Part 3:

We created a producer thread and a queue for emergency landings, we also created two separate emergency queues for PadA and PadB. Now, the control tower first checks whether there are emergency jobs waiting, if so it gives one of them to PadA and the other one to PadB. Pads first check if they have something in their emergency queue and do the emergency job if there is one.

C proi	ect_2.c	E log	.txt U ×					
			itat o x					
part_1 1	> ≣ log.tx		Poguest	Timo	End T	imo	Turnaround	Timo Pod
2	70	D D	Request 0	ı ııııe,		4	4	A
3	201		2			6		В
4	440					8		Α
5	744				1			Α
6	795		8		1			Α
7	120		10		1			В
8 9	424 731	L L	12 16		1 2			A A
10	389	L	18		2		4	В
11	376	Ĺ	20		2		4	A
12	450		22		2	6		В
13	982		24		2	8		Α
14	253		28		3			A
15	30		30		3			A
16	299		32		3			A
17 18	80 961	L A	34 18		3 4		4 22	A B
19	869	Ĺ	36		4		4	A
20	807	Ĺ	38		4		6	В
21	974		40					A
22	994		42		4	8		В
23	687		44					Α
24	585		46		5			В
25	194		48		5			A
26	382 345	L L	50		5		6 4	В
27 28	345 452	L	52 54		5 6		6	A B
29	574	Ĺ	56		6			A
30	276	L	60		6			A
31	151		62		6	6		Α
32	244		64		6	8		Α
33	729		66		7			А
34	475		68		7		4	A
35	415	A	36		7		38	B A
36 37	312 472	L L	72 74		7 7			A A
38	543	Ĺ	76		8		4	A
39	718		78		8			A
40	472		80		8			Α
41	612		82		8	6		Α
42	773	Α	56		8		32	В
43	613		84		8			A
44	440	L L	86		9		6	В
45 46	882 588	L	88 90		9 9			A B
47	936		92		9			A
48	468	Ĺ	94		10			В
49	597		96		10			Α
50	421		98		10	4		В
51	856		100		10			А
52	382		102		10			В
53	571		104		10			A
54 55	241 445		106 108		11 11		6 4	В
55 56	802	L	110		11		6	A B
57	187	Ĺ	112		11			A
58	193		114		12			В
59	562		116		12			А
60								

≣ log.t	xt U ×								
part_2	> ≣ log.t	txt							
1				Time,	End		Turnaround	Time,	
2	70		0						A
3 4	992 415	L L	2 6			6 12	4 6		B A
5	415	L	8			12	o 4		В
6	442	Ĺ	12			16			A
7	95		14			18			A
8	821		16			20			Α
9	670		18			22			Α
10	961		20			24			Α
11	855	Α .	12			26	14		В
12 13	897 831	L D	22 22			26 30	4 8		A A
14	398	L	24			32	8		A
15	652	Ĺ	30			34			В
16	397		32			36			A
17	80		36			40			Α
18	869		38			42			В
19	807		40			44			В
20	415		38			45			A
21	974		42			46			В
22 23	994 687	L L	44 46			49 50	5 4		A B
24	585	Ĺ	48			52	4		В
25	586	D	47			53	6		A
26	194		50			55			В
27	382		53			57			Α
28	345		55			59			В
29	452		57			61			Α
30	574		59			63			В
31	276		63			67			A
32 33	151 6	L D	65 65			69 73	4 8		A A
34	773	A	59			75	16		В
35	244	Ë	67			75	8		A
36	729		69			77	8		Α
37	312		75			79			В
38	475		71			79	8		Α
39	472		77			81			Α
40	543		79			83			В
41	718	L L	81			85	4 4		A
42 43	472 612	L	83 85			87 89	4		B A
44	613	Ĺ	87			91	4		A
45	440	L	89			93			A
46	882		91			95			Α
47	380	Α	83			99	16		В
48	582		91			99	8		Α
49	588		93			101	8		A
50	936	L L	95 97			L03	8		A
51 52	468 597	L	97 99			L05 L07	8 8		A A
53	421	Ĺ	101			109	8		A
54	943	A	89			11	22		В
55	856		103			11	8		A
56	382		105			13	8		Α
57	571		107			15	8		Α
58	241		109			19	10		A
59	445	L	111			21	10		A
60 61	344 	Α	99		1	.23	24		В
01									

Part 3 Elog.txt Event10, Status, Request Time, End Time, Turnaround Time, Pad 2 79	≣ log	g.txt U	×				
Pace Pace	part_	_3 > ≣ k	og.txt				
3 201 L 2 6 4 A A 5 459 L 6 8 2 B 6 8 2 B 6 8 2 B 6 8 2 B 6 8 2 B 8 1 1 6 4 A A A 7 808 L 12 16 4 A A A 7 9 571 L 18 22 4 A A A 29 571 L 18 22 4 A A A 12 30 4 4 A A 12 20 34 4 A A 12 30 4 A A A 4 A A 14 8 A A A A A A A A A A A A A A A </td <td></td> <td></td> <td></td> <td>Request</td> <td>Time, End Time</td> <td>e, Turnaround</td> <td>Time, Pad</td>				Request	Time, End Time	e, Turnaround	Time, Pad
4 440 L 4 8 4 A 5 459 L 6 8 2 B 6 870 L 8 12 4 A 7 808 L 12 16 4 A 8 147 L 16 20 4 A A 10 269 L 20 24 4 A A 11 398 L 24 28 32 4 A 12 739 L 28 32 4 A 13 961 A 20 34 14 B 14 80 L 36 40 4 A A 15 869 L 38 42 4 A A 16 807 L 40 44 4 A A A A A		70		0			А
5 459 L 6 8 2 B 6 870 L 8 12 4 A 7 808 L 12 16 4 A 8 147 L 16 20 4 A 10 269 L 20 24 4 A 11 398 L 24 28 4 A 12 739 L 28 32 4 A 14 80 L 36 40 4 A A 15 869 L 38 42 4 A A 16 887 L 40 44 A		201	L	2			В
6 870 L 8 12 4 A 7 898 L 12 16 4 A 8 147 L 16 20 4 A 9 571 L 18 22 4 B 10 269 L 20 24 4 A 11 398 L 24 28 4 A 12 739 L 28 32 4 A 13 961 A 20 34 14 B 15 869 L 36 40 4 A 15 869 L 38 42 4 A 16 897 L 40 44 4 A 17 831 A 22 46 4 A 18 974 L 42 46 4 A 19 521 L 46 48 2 A 19 521 L 46 48 50 2 A 21 585 D 50 50 54 4 A 22 415 A 40 58 18 B 23 382 L 54 5 58 62 4 B 24 345 L 56 60 4 A 25 452 L 58 62 4 B 26 600 L 60 62 2 A 27 773 L 62 64 68 4 B 31 269 L 60 62 2 A 27 773 L 62 64 68 4 B 31 269 L 58 62 A 31 30 64 A A 33 475 L 70 74 4 B 33 475 L 70 74 4 B 34 487 L 74 76 2 A 35 753 L 76 80 82 A 36 60 A A 37 543 E 80 80 82 2 B 38 82 L 76 6 80 82 A 38 82 L 76 88 74 6 A 39 768 L 88 74 6 A 30 768 L 88 74 76 2 A 31 269 L 70 74 4 B 33 475 L 72 76 A 34 487 L 74 76 2 A 35 753 L 76 80 82 A 36 60 82 L 10 6 A 37 543 E 80 82 2 B 38 303 E 80 82 2 B 38 303 E 80 82 2 B 39 243 L 80 84 88 4 A 40 380 L 84 88 92 A 40 380 L 84 88 92 A 40 380 L 84 88 92 A 40 380 L 88 89 84 A 40 380 L 88 92 A 41 764 L 88 99 A 42 959 L 90 99 A 44 B 45 959 L 90 99 A 46 68 A 47 943 A 92 106 110 A 48 597 L 100 102 110 B 48 697 L 100 102 110 B 55 445 L 110 114 4 B 56 802 L 114 118 4 B			L		8		A
7 888 L 12 16 4 A 8 147 L 16 20 4 A 9 571 L 18 22 4 B 10 269 L 20 24 4 A 11 398 L 24 28 4 A 12 739 L 28 32 4 A 13 961 A 20 34 14 B 14 80 L 36 40 4 A 15 869 L 38 42 4 A 16 897 L 40 44 4 A 17 831 A 22 46 24 B 18 974 L 42 46 4 A 18 974 L 42 46 4 A <			L	6		2	В
8 147 L 16 20 4 A 9 571 L 18 22 4 B 10 269 L 20 24 4 A 11 398 L 24 28 4 A 12 739 L 28 32 4 A 13 961 A 20 34 14 B 14 80 L 36 40 4 A 15 869 L 38 42 4 A 16 897 L 40 44 4 A 17 831 A 22 46 24 B 18 974 L 42 46 4 A A 20 586 L 48 59 2 A 21 585 D 59 54 4 A 22 415 A 40 58 18 B							
9 571 L 18 22 4 A B 10 269 L 20 24 4 A A 11 398 L 24 28 32 4 A 12 739 L 28 32 4 A 13 961 A 20 34 14 B 15 869 L 36 40 4 A 16 807 L 40 44 4 A 17 831 A 22 46 24 B 18 974 L 42 46 4 A 19 521 L 46 48 50 2 A 19 585 D 50 54 4 A 22 415 A 40 58 18 B 23 382 L 54 58 4 A 22 415 A 40 58 18 B 23 382 L 56 60 4 A 25 452 L 58 62 4 B 26 574 L 60 62 2 A 27 773 L 62 64 2 A 28 600 L 64 68 4 B 29 307 L 66 70 4 B 30 768 L 68 72 4 B 31 269 L 70 74 4 B 32 413 D 68 74 6 A 33 475 L 74 76 2 A 35 753 L 76 80 82 2 A 36 80 4 B 37 543 E 80 82 2 A 38 80 82 2 A 39 243 L 76 88 89 2 A 30 768 L 68 72 4 B 31 269 L 70 74 4 B 32 413 D 68 74 6 A 35 753 L 76 80 82 2 A 36 80 4 B 37 543 E 80 82 2 A 38 80 82 2 A 38 80 82 2 A 39 243 L 84 88 92 4 A 41 764 L 88 92 9 98 6 A 44 88 4 B 47 764 L 88 99 9 94 4 B 48 597 L 100 106 110 4 B 38 88							
10 269 L 20 24 4 A 11 398 L 24 28 4 A 12 739 L 28 32 4 A 13 961 A 20 34 14 B 14 88 L 36 49 4 A 15 869 L 38 42 4 A 16 807 L 40 44 4 A 17 831 A 22 46 24 B 18 974 L 42 46 4 A 19 521 L 46 48 2 A 20 586 L 48 50 2 A 21 585 D 50 54 4 A 22 415 A 40 58 18 B							
111 398 L 24 28 32 4 A 12 739 L 28 32 4 A 13 961 A 20 34 14 B 14 88 L 36 40 4 A A 15 869 L 38 42 4 A A 16 887 L 40 44 4 A A A 17 831 A 22 46 4 A A A 19 521 L 46 48 2 A A A 19 521 L 46 48 50 2 A A 20 586 L 48 50 2 A A 4 A A A 40 58 18 B B 23 382 L 54 58 4 A A A 4 A A A 4 A A A 4 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>							
12 739 L 28 32 4 A 13 961 A 20 34 14 B 14 80 L 36 48 4 A A 15 869 L 38 42 4 A A 16 887 L 40 44 4 A A 17 831 A 22 46 24 B B 18 974 L 42 46 4 A A 19 521 L 46 48 2 A A 20 586 L 48 50 2 A A 4 A 8 2 A A 4 A A 22 415 A 40 58 18 B B 23 382 L 54 58 4 A A 24 4 A							
13 961 A 20 34 14 B 14 80 L 36 40 4 A 15 869 L 38 42 4 A 16 807 L 40 44 4 A 17 831 A 22 46 24 B 18 974 L 42 46 4 A 19 521 L 46 48 50 2 A 20 586 L 48 50 2 A A 21 585 D 50 54 4 A A 22 415 A 40 58 18 B B 23 382 L 54 58 4 A A 25 452 L 56 60 4 A A 25 45							
14 80 L 36 40 4 A 15 869 L 38 42 4 A 16 807 L 40 44 4 A 17 831 A 22 46 24 B 18 974 L 42 46 4 A 19 521 L 46 48 2 A 20 586 L 48 50 2 A 21 585 D 50 54 4 A 22 415 A 40 58 18 B 23 382 L 54 58 4 A A 25 452 L 56 60 4 A A 25 452 L 58 62 4 B B 26 574 L 60 62 2 A B B 26 574 L 60 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>							
15 869 L 38 42 4 A 16 807 L 40 44 4 A 17 831 A 22 46 24 B 18 974 L 42 46 4 A 19 521 L 46 48 2 A 20 586 L 48 50 2 A 21 585 D 50 54 A A 22 415 A 40 58 18 B 23 382 L 54 58 4 A A 24 345 L 56 60 4 A A A 25 452 L 58 62 4 B A							
16 897 L 40 44 4 A 17 831 A 22 46 24 B 18 974 L 42 46 4 A 19 521 L 46 48 2 A 20 586 L 48 50 2 A 21 585 D 50 54 4 A 22 415 A 40 58 18 B 23 382 L 54 58 4 A 24 345 L 56 60 4 A 25 452 L 58 62 4 B 26 574 L 60 62 2 A 28 600 L 64 68 4 B 29 307 L 66 70 4 A 30 768 L 68 72 4 B 31							
17 831 A 22 46 24 B 18 974 L 42 46 4 A 19 521 L 46 48 2 A 20 586 L 48 50 2 A 21 585 D 50 54 4 A 22 415 A 40 58 18 B 23 382 L 54 58 4 A 24 345 L 56 60 4 A 25 452 L 58 62 4 B 26 574 L 60 62 2 A 27 773 L 62 64 2 A 29 307 L 66 70 4 A 39 768 L 68 72 4 B 31 269 L 70 74 4 B 32							
18 974 L 42 46 4 A 19 521 L 46 48 2 A 20 586 L 48 50 2 A 21 585 D 50 54 4 A 21 585 D 50 54 4 A 22 415 A 40 58 18 B 23 382 L 54 58 4 A A 24 345 L 56 60 4 A A 25 452 L 58 62 4 B 22 A A A 25 452 L 60 62 2 A B 26 574 L 60 62 2 A B 29 307 L 66 70 4 A B 31 269 L 7							
19 521 L 46 48 2 A 20 586 L 48 50 2 A 21 585 D 50 54 4 A 22 415 A 40 58 18 B 23 382 L 54 58 4 A 24 345 L 56 60 4 A 25 452 L 58 62 4 B 26 574 L 60 62 2 A 27 773 L 62 64 2 A 28 600 L 64 68 4 B 29 307 L 66 70 4 A 30 768 L 68 72 4 B 31 269 L 70 74 4 B							
20 586 L 48 50 2 A 21 585 D 50 54 4 A 22 415 A 40 58 18 B 23 382 L 54 58 4 A 24 345 L 56 60 4 A 25 452 L 58 62 4 B 26 574 L 60 62 2 A 27 773 L 62 64 2 A 28 600 L 64 68 4 B 29 307 L 66 70 4 A B 31 269 L 70 74 4 B B 31 269 L 70 74 4 B B 32 413 D 68 7							
21 585 D 50 54 4 A 22 415 A 40 58 18 B 23 382 L 54 58 4 A 24 345 L 56 60 4 A 25 452 L 58 62 4 B 26 574 L 60 62 2 A 27 773 L 62 64 2 A 28 600 L 64 68 4 B 29 307 L 66 70 4 A A 30 768 L 68 72 4 B B 31 269 L 70 74 4 B A 32 413 D 68 74 6 A B 34 487 L 74			L	48			А
23 382 L 54 58 4 A 24 345 L 56 60 4 A 25 452 L 58 62 4 B 26 574 L 60 62 2 A 27 773 L 62 64 2 A 28 600 L 64 68 4 B 29 307 L 66 70 4 A 30 768 L 68 72 4 B 31 269 L 70 74 4 B 32 413 D 68 74 6 A 33 475 L 72 76 4 B 34 487 L 74 76 2 A 35 753 L 76 80 4 B 36 132 L 78 80 2 2 A		585		50	54		Α
24 345 L 56 60 4 A 25 452 L 58 62 4 B 26 574 L 60 62 2 A 27 773 L 62 64 2 A 28 600 L 64 68 4 B 29 397 L 66 70 4 A 30 768 L 68 72 4 B 31 269 L 70 74 4 B 32 413 D 68 74 6 A 33 475 L 72 76 4 B 34 487 L 74 76 2 A 35 753 L 76 80 4 B 36 132 L 78 80 2 A 37 543 E 80 82 2 A 38	22	415	Α	40	58	18	В
25 452 L 58 62 4 B 26 574 L 60 62 2 A 27 773 L 62 64 2 A 28 600 L 64 68 4 B 29 307 L 66 70 4 A 30 768 L 68 72 4 B 31 269 L 70 74 4 B 32 413 D 68 74 6 A 32 413 D 68 74 6 A 33 475 L 72 76 4 B 34 487 L 74 76 2 A 35 753 L 76 80 4 B 36 132 L 78 80 2 A 37 543 E 80 82 2 B 38	23	382	L	54	58		А
26 574 L 60 62 2 A 27 773 L 62 64 2 A 28 600 L 64 68 4 B 29 307 L 66 70 4 A 30 768 L 68 72 4 B 31 269 L 70 74 4 B 32 413 D 68 74 6 A 32 413 D 68 74 6 A 33 475 L 72 76 4 B 34 487 L 74 76 2 A 35 753 L 76 80 4 B 36 132 L 78 80 2 A 37 543 E 80 82 2 B 38 303 E 80 82 2 A 39		345	L	56	60		Α
27 773 L 62 64 2 A 28 600 L 64 68 4 B 29 307 L 66 70 4 A 30 768 L 68 72 4 B 31 269 L 70 74 4 B 32 413 D 68 74 6 A B 32 413 D 68 74 6 A B 34 487 L 72 76 4 B 34 487 L 74 76 2 A 35 753 L 76 80 4 B 36 132 L 78 80 2 A 37 543 E 80 82 2 B 38 303 E 80 82 2 A 39 243 L 80 84 4 B <td>25</td> <td>452</td> <td>L</td> <td>58</td> <td>62</td> <td></td> <td>В</td>	25	452	L	58	62		В
28 600 L 64 68 4 B 29 307 L 66 70 4 A 30 768 L 68 72 4 B 31 269 L 70 74 4 B 32 413 D 68 74 6 A 33 475 L 72 76 4 B 34 487 L 74 76 2 A 35 753 L 76 80 4 B 36 132 L 78 80 2 A 37 543 E 80 82 2 B 38 303 E 80 82 2 A 39 243 L 80 84 4 B 40 380 L 84 88 4 A 41 764 L 88 92 4 A 43			L				A
29 307 L 666 70 4 A 30 768 L 68 72 4 B 31 269 L 70 74 4 B 32 413 D 68 74 6 A 33 475 L 72 76 4 B 34 487 L 74 76 2 A 35 753 L 76 80 4 B 36 132 L 78 80 2 A 37 543 E 80 82 2 B 38 303 E 80 82 2 A 39 243 L 80 84 4 B 40 380 L 84 88 4 A 41 764 L 88 92 4 A			L	62		2	A
30 768 L 68 72 4 B 31 269 L 70 74 4 B 32 413 D 68 74 6 A 33 475 L 72 76 4 B 34 487 L 74 76 2 A 35 753 L 76 80 4 B 36 132 L 78 80 2 A 37 543 E 80 82 2 B 38 303 E 80 82 2 A 39 243 L 80 84 4 B 40 380 L 84 88 4 A 41 764 L 88 92 4 A 42 959 L 90 94 4 B							
31 269 L 70 74 4 B 32 413 D 68 74 6 A 33 475 L 72 76 4 B 34 487 L 74 76 2 A 35 753 L 76 80 4 B 36 132 L 78 80 2 A 37 543 E 80 82 2 B 38 303 E 80 82 2 A 39 243 L 80 84 4 B 40 380 L 84 88 4 A 41 764 L 88 92 4 A 41 764 L 88 92 4 A 43 882 D 92 98 6 A 44 582 L 92 100 8 A 45							
32 413 D 68 74 6 A 33 475 L 72 76 4 B 34 487 L 74 76 2 A 35 753 L 76 89 4 B 36 132 L 78 80 2 A 37 543 E 80 82 2 B 38 303 E 80 82 2 A 39 243 L 80 84 4 B 40 380 L 84 88 4 A 41 764 L 88 92 4 A 41 764 L 88 92 4 A 43 882 D 92 98 6 A 44 582 L 92 100 8 A 45 936 L 96 102 6 A 46							
33 475 L 72 76 4 B 34 487 L 74 76 2 A 35 753 L 76 80 4 B 36 132 L 78 80 2 A 37 543 E 80 82 2 B 38 303 E 80 82 2 A 39 243 L 80 84 4 B 40 380 L 84 88 4 A 41 764 L 88 92 4 A 42 959 L 90 94 4 B 43 882 D 92 98 6 A 44 582 L 92 100 8 A 45 936 L 96 102 6 A							
34 487 L 74 76 2 A 35 753 L 76 80 4 B 36 132 L 78 80 2 A 37 543 E 80 82 2 B 38 303 E 80 82 2 A 39 243 L 80 84 4 B 40 380 L 84 88 4 A 41 764 L 88 92 4 A 42 959 L 90 94 4 B 43 882 D 92 98 6 A 44 582 L 92 100 8 A 45 936 L 96 102 6 A 46 468 L 98 104 6 A 47 943 A 92 106 14 B 48							
35 753 L 76 80 4 B 36 132 L 78 80 2 A 37 543 E 80 82 2 B 38 303 E 80 82 2 A 39 243 L 80 84 4 B 40 380 L 84 88 4 A 40 380 L 84 88 4 A 41 764 L 88 92 4 A 42 959 L 90 94 4 B 43 882 D 92 98 6 A 44 582 L 92 100 8 A 45 936 L 96 102 6 A 47 943 A 92 106 14 B							
36 132 L 78 80 2 A 37 543 E 80 82 2 A 38 303 E 80 82 2 A 39 243 L 80 84 4 B 40 380 L 84 88 4 A 41 764 L 88 92 4 A 41 764 L 88 92 4 A 42 959 L 90 94 4 B 43 882 D 92 98 6 A 44 582 L 92 100 8 A 45 936 L 96 102 6 A 46 468 L 98 104 6 A 47 943 A 92 106 14 B 48 597 L 100 106 6 A 49 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>							
37 543 E 80 82 2 A 38 303 E 80 82 2 A 39 243 L 80 84 4 B 40 380 L 84 88 4 A 41 764 L 88 92 4 A 42 959 L 90 94 4 B 43 882 D 92 98 6 A 44 582 L 92 100 8 A 45 936 L 96 102 6 A 46 468 L 98 104 6 A 47 943 A 92 106 14 B 48 597 L 100 106 6 A 49 382 L 106 110 4 B 50 344 D 102 110 8 A 51							
38 303 E 80 82 2 A 39 243 L 80 84 4 B 40 380 L 84 88 4 A 41 764 L 88 92 4 A 42 959 L 90 94 4 B 43 882 D 92 98 6 A 44 582 L 92 100 8 A 45 936 L 96 102 6 A 46 468 L 98 104 6 A 47 943 A 92 106 14 B 48 597 L 100 106 6 A 49 382 L 106 110 4 B 50 344 D 102 110 8 A 51 571 L 108 112 4 B							
39 243 L 80 84 4 A 40 380 L 84 88 4 A 41 764 L 88 92 4 A 42 959 L 90 94 4 B 43 882 D 92 98 6 A 44 582 L 92 100 8 A 45 936 L 96 102 6 A 46 468 L 98 104 6 A 47 943 A 92 106 14 B 48 597 L 100 106 6 A 49 382 L 106 110 4 B 50 344 D 102 110 8 A 51 571 L 108 112 4 B 52 421 L 102 112 10 A <							
40 380 L 84 88 4 A 41 764 L 88 92 4 A 42 959 L 90 94 4 B 43 882 D 92 98 6 A 44 582 L 92 100 8 A 45 936 L 96 102 6 A 46 468 L 98 104 6 A 47 943 A 92 106 14 B 48 597 L 100 106 6 A 49 382 L 106 110 4 B 50 344 D 102 110 8 A 51 571 L 108 112 4 B 52 421 L 102 112 10 A 53 241 L 110 114 4 B							
41 764 L 88 92 4 A 42 959 L 90 94 4 B 43 882 D 92 98 6 A 44 582 L 92 100 8 A 45 936 L 96 102 6 A 46 468 L 98 104 6 A 47 943 A 92 106 14 B 48 597 L 100 106 6 A 49 382 L 106 110 4 B 50 344 D 102 110 8 A 51 571 L 108 112 4 B 52 421 L 102 112 10 A 53 241 L 110 114 4 B 54 856 L 104 114 10 A							
42 959 L 90 94 4 B 43 882 D 92 98 6 A 44 582 L 92 100 8 A 45 936 L 96 102 6 A 46 468 L 98 104 6 A 47 943 A 92 106 14 B 48 597 L 100 106 6 A 49 382 L 100 106 6 A 50 344 D 102 110 8 A 51 571 L 108 112 4 B 52 421 L 102 112 10 A 53 241 L 110 114 4 B 54 856 L 104 114 10 A 55 445 L 112 116 4 A			L				
44 582 L 92 100 8 A 45 936 L 96 102 6 A 46 468 L 98 104 6 A 47 943 A 92 106 14 B 48 597 L 100 106 6 A 49 382 L 106 110 4 B 50 344 D 102 110 8 A 51 571 L 108 112 4 B 52 421 L 102 112 10 A 53 241 L 110 114 4 B 54 856 L 104 114 10 A 55 445 L 112 116 4 A 56 802 L 114 118 4 B 57 187 L 116 120 4 A <td>42</td> <td>959</td> <td>L</td> <td>90</td> <td>94</td> <td></td> <td>В</td>	42	959	L	90	94		В
45 936 L 96 102 6 A 46 468 L 98 104 6 A 47 943 A 92 106 14 B 48 597 L 100 106 6 A 49 382 L 106 110 4 B 50 344 D 102 110 8 A 51 571 L 108 112 4 B 52 421 L 102 112 10 A 53 241 L 110 114 4 B 54 856 L 104 114 10 A 55 445 L 112 116 4 A 56 802 L 114 118 4 B 57 187 L 116 120 4 A	43	882		92	98		А
46 468 L 98 104 6 A 47 943 A 92 106 14 B 48 597 L 100 106 6 A 49 382 L 106 110 4 B 50 344 D 102 110 8 A 51 571 L 108 112 4 B 52 421 L 102 112 10 A 53 241 L 110 114 4 B 54 856 L 104 114 10 A 55 445 L 112 116 4 A 56 802 L 114 118 4 B 57 187 L 116 120 4 A	44	582	L	92	100	8	Α
47 943 A 92 106 14 B 48 597 L 100 106 6 A 49 382 L 106 110 4 B 50 344 D 102 110 8 A 51 571 L 108 112 4 B 52 421 L 102 112 10 A 53 241 L 110 114 4 B 54 856 L 104 114 10 A 55 445 L 112 116 4 A 56 802 L 114 118 4 B 57 187 L 116 120 4 A	45	936	L	96		6	А
48 597 L 100 106 6 A 49 382 L 106 110 4 B 50 344 D 102 110 8 A 51 571 L 108 112 4 B 52 421 L 102 112 10 A 53 241 L 110 114 4 B 54 856 L 104 114 10 A 55 445 L 112 116 4 A 56 802 L 114 118 4 B 57 187 L 116 120 4 A							
49 382 L 106 110 4 B 50 344 D 102 110 8 A 51 571 L 108 112 4 B 52 421 L 102 112 10 A 53 241 L 110 114 4 B 54 856 L 104 114 10 A 55 445 L 112 116 4 A 56 802 L 114 118 4 B 57 187 L 116 120 4 A							
50 344 D 102 110 8 A 51 571 L 108 112 4 B 52 421 L 102 112 10 A 53 241 L 110 114 4 B 54 856 L 104 114 10 A 55 445 L 112 116 4 A 56 802 L 114 118 4 B 57 187 L 116 120 4 A							
51 571 L 108 112 4 B 52 421 L 102 112 10 A 53 241 L 110 114 4 B 54 856 L 104 114 10 A 55 445 L 112 116 4 A 56 802 L 114 118 4 B 57 187 L 116 120 4 A							
52 421 L 102 112 10 A 53 241 L 110 114 4 B 54 856 L 104 114 10 A 55 445 L 112 116 4 A 56 802 L 114 118 4 B 57 187 L 116 120 4 A							
53 241 L 110 114 4 B 54 856 L 104 114 10 A 55 445 L 112 116 4 A 56 802 L 114 118 4 B 57 187 L 116 120 4 A							
54 856 L 104 114 10 A 55 445 L 112 116 4 A 56 802 L 114 118 4 B 57 187 L 116 120 4 A							
55 445 L 112 116 4 A 56 802 L 114 118 4 B 57 187 L 116 120 4 A							
56 802 L 114 118 4 B 57 187 L 116 120 4 A							
57 187 L 116 120 4 A							
		10/		110	120	4	A