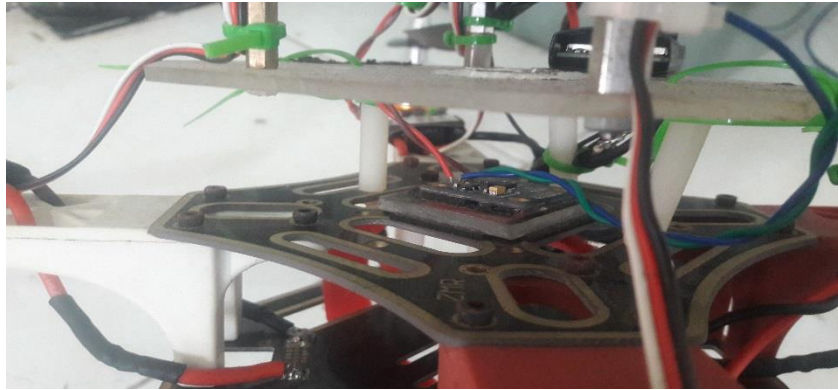


LAMPIRAN 1

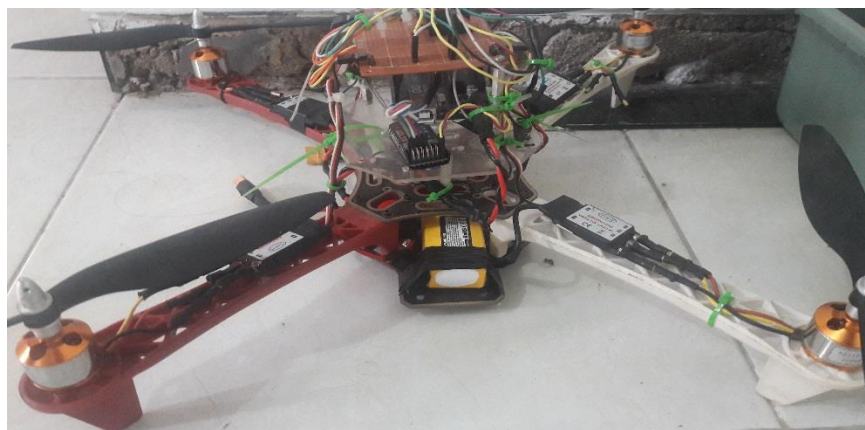
DOKUMENTASI ALAT



SENSOR GYRO(MPU6050)



MOTOR BLDC OUTRUNNER



KESELURUHAN SISTEM
QUADCOPTER

LAMPIRAN 2
DATA PENGUJIAN

Data pengujian seluruh sistem *Quadcopter* dengan setpoint 0°

Setpoint	Roll	Pitch	Yaw	Error Roll	Error Pith	Error Yaw
0	0.1	0	-0.12	-0.1	0	0.12
0	0.11	0.02	0.03	-0.11	-0.02	-0.03
0	0.05	0	0.12	-0.05	0	-0.12
0	0.05	0	0.26	-0.05	0	-0.26
0	0.1	0	0.41	-0.1	0	-0.41
0	0.12	0.03	0.45	-0.12	-0.03	-0.45
0	0.08	0.02	0.52	-0.08	-0.02	-0.52
0	0.09	-0.01	0.56	-0.09	0.01	-0.56
0	0.09	-0.03	0.57	-0.09	0.03	-0.57
0	0.1	0	0.68	-0.1	0	-0.68
0	0.08	-0.04	0.66	-0.08	0.04	-0.66
0	0.1	-0.03	0.6	-0.1	0.03	-0.6
0	0.14	-0.04	0.55	-0.14	0.04	-0.55
0	0.1	0.02	0.52	-0.1	-0.02	-0.52
0	0.09	0.06	0.47	-0.09	-0.06	-0.47
0	0.13	0.1	0.44	-0.13	-0.1	-0.44
0	0.13	0.08	0.49	-0.13	-0.08	-0.49
0	0.13	0.07	0.48	-0.13	-0.07	-0.48
0	0.2	0.08	0.39	-0.2	-0.08	-0.39
0	0.17	0.04	0.47	-0.17	-0.04	-0.47
0	0.15	0.04	0.49	-0.15	-0.04	-0.49
0	0.15	0.07	0.57	-0.15	-0.07	-0.57
0	0.15	0.08	0.61	-0.15	-0.08	-0.61
0	0.17	0.1	0.64	-0.17	-0.1	-0.64
0	0.16	0.1	0.65	-0.16	-0.1	-0.65
0	0.17	0.09	0.56	-0.17	-0.09	-0.56
0	0.21	0.06	0.52	-0.21	-0.06	-0.52
0	0.22	0.02	0.53	-0.22	-0.02	-0.53
0	0.13	0.04	0.51	-0.13	-0.04	-0.51
0	0.13	0.07	0.44	-0.13	-0.07	-0.44
0	0.12	0.06	0.44	-0.12	-0.06	-0.44
0	0.13	0.08	0.41	-0.13	-0.08	-0.41
0	0.12	0.1	0.45	-0.12	-0.1	-0.45
0	0.13	0.08	0.47	-0.13	-0.08	-0.47
0	0.14	0.06	0.52	-0.14	-0.06	-0.52
0	0.15	0.05	0.46	-0.15	-0.05	-0.46
0	0.12	0.05	0.47	-0.12	-0.05	-0.47
0	0.09	0.03	0.52	-0.09	-0.03	-0.52
0	0.13	0.07	0.48	-0.13	-0.07	-0.48
0	0.14	0.12	0.51	-0.14	-0.12	-0.51

0	0.08	0.1	0.53	-0.08	-0.1	-0.53
0	0.07	0.13	0.47	-0.07	-0.13	-0.47
0	0.1	0.08	0.45	-0.1	-0.08	-0.45
0	0.11	0.12	0.55	-0.11	-0.12	-0.55
0	0.15	0.1	0.54	-0.15	-0.1	-0.54
0	0.14	0.08	0.51	-0.14	-0.08	-0.51
0	0.18	0.09	0.45	-0.18	-0.09	-0.45
0	0.18	0.09	0.44	-0.18	-0.09	-0.44
0	0.21	0.08	0.45	-0.21	-0.08	-0.45
0	0.18	0.07	0.44	-0.18	-0.07	-0.44
0	0.15	0.09	0.48	-0.15	-0.09	-0.48
0	0.12	0.09	0.42	-0.12	-0.09	-0.42
0	0.06	0.06	0.58	-0.06	-0.06	-0.58
0	0.11	0.11	0.56	-0.11	-0.11	-0.56
0	0.12	0.12	0.46	-0.12	-0.12	-0.46
0	0.14	0.12	0.4	-0.14	-0.12	-0.4
0	0.17	0.1	0.41	-0.17	-0.1	-0.41
0	0.21	0.1	0.44	-0.21	-0.1	-0.44
0	0.15	0.13	0.53	-0.15	-0.13	-0.53
0	0.17	0.15	0.53	-0.17	-0.15	-0.53
0	0.17	0.14	0.5	-0.17	-0.14	-0.5
0	0.13	0.16	0.5	-0.13	-0.16	-0.5
0	0.11	0.12	0.56	-0.11	-0.12	-0.56
0	0.09	0.11	0.59	-0.09	-0.11	-0.59
0	0.14	0.1	0.53	-0.14	-0.1	-0.53
0	0.16	0.12	0.55	-0.16	-0.12	-0.55
0	0.18	0.09	0.56	-0.18	-0.09	-0.56
0	0.18	0.1	0.48	-0.18	-0.1	-0.48
0	0.18	0.07	0.47	-0.18	-0.07	-0.47
0	0.19	0.13	0.41	-0.19	-0.13	-0.41
0	0.17	0.13	0.4	-0.17	-0.13	-0.4
0	0.13	0.09	0.46	-0.13	-0.09	-0.46
0	0.12	0.04	0.5	-0.12	-0.04	-0.5
0	0.09	0.03	0.5	-0.09	-0.03	-0.5
0	0.08	0.04	0.54	-0.08	-0.04	-0.54
0	0.1	0.05	0.46	-0.1	-0.05	-0.46
0	0.09	0.05	0.42	-0.09	-0.05	-0.42
0	0.13	0.05	0.45	-0.13	-0.05	-0.45
0	0.17	0.07	0.47	-0.17	-0.07	-0.47
0	0.24	0.11	0.45	-0.24	-0.11	-0.45
0	0.2	0.02	0.45	-0.2	-0.02	-0.45
0	0.24	0.02	0.47	-0.24	-0.02	-0.47

0	0.25	-0.03	0.56	-0.25	0.03	-0.56
0	0.22	-0.02	0.56	-0.22	0.02	-0.56
0	0.15	-0.01	0.43	-0.15	0.01	-0.43
0	0.2	0.02	0.39	-0.2	-0.02	-0.39
0	0.27	-0.03	0.47	-0.27	0.03	-0.47
0	0.2	0	0.49	-0.2	0	-0.49
0	0.17	-0.09	0.47	-0.17	0.09	-0.47
0	0.2	-0.08	0.45	-0.2	0.08	-0.45
0	0.22	0.03	0.52	-0.22	-0.03	-0.52
0	0.16	-0.03	0.36	-0.16	0.03	-0.36
0	0.14	-0.02	0.39	-0.14	0.02	-0.39
0	-0.08	-0.21	0.38	0.08	0.21	-0.38
0	-0.01	-0.23	0.31	0.01	0.23	-0.31
0	0.07	-0.19	0.36	-0.07	0.19	-0.36
0	0.05	-0.11	0.42	-0.05	0.11	-0.42
0	0.14	-0.02	0.58	-0.14	0.02	-0.58
0	0.11	-0.03	0.64	-0.11	0.03	-0.64
0	0.16	-0.02	0.61	-0.16	0.02	-0.61
0	0.1	-0.04	0.68	-0.1	0.04	-0.68
0	0.2	-0.42	0.63	-0.2	0.42	-0.63
0	0.23	-0.6	0.51	-0.23	0.6	-0.51
0	0.42	-0.35	0.52	-0.42	0.35	-0.52
0	0.53	0.05	0.36	-0.53	-0.05	-0.36
0	0.58	-0.04	0.47	-0.58	0.04	-0.47
0	0.67	0.08	0.53	-0.67	-0.08	-0.53
0	1.04	0.35	0.71	-1.04	-0.35	-0.71
0	0.78	0.18	1.44	-0.78	-0.18	-1.44
0	1	-0.4	1.79	-1	0.4	-1.79
0	1	-0.89	1.59	-1	0.89	-1.59
0	0.92	-0.95	0.92	-0.92	0.95	-0.92
0	0.83	-0.1	0.17	-0.83	0.1	-0.17
0	-0.81	0.17	0.04	0.81	-0.17	-0.04
0	-2.09	0.8	-0.18	2.09	-0.8	0.18
0	-2.28	0.9	-0.21	2.28	-0.9	0.21
0	-0.53	0.25	0.08	0.53	-0.25	-0.08
0	1.8	-0.99	0.37	-1.8	0.99	-0.37
0	3.44	-1.26	0.32	-3.44	1.26	-0.32
0	2.81	0.1	0.4	-2.81	-0.1	-0.4
0	0.37	1.66	0.42	-0.37	-1.66	-0.42
0	-1.59	2.59	-0.28	1.59	-2.59	0.28
0	-1.54	2.36	-0.47	1.54	-2.36	0.47
0	-0.36	0.96	-0.24	0.36	-0.96	0.24

0	1.59	-0.45	0.42	-1.59	0.45	-0.42
0	2.37	-1.22	0.93	-2.37	1.22	-0.93
0	1.22	-0.97	0.71	-1.22	0.97	-0.71
0	-0.21	-0.21	0.43	0.21	0.21	-0.43
0	-0.22	0.25	0.21	0.22	-0.25	-0.21
0	0.49	0.1	0.14	-0.49	-0.1	-0.14
0	0.51	-0.2	-0.08	-0.51	0.2	0.08
0	-0.26	0.34	-0.35	0.26	-0.34	0.35
0	-0.76	0.44	-0.27	0.76	-0.44	0.27
0	0.07	-0.56	0.04	-0.07	0.56	-0.04
0	1.64	-2.31	0.09	-1.64	2.31	-0.09
0	-0.06	-0.98	0.12	0.06	0.98	-0.12
0	-1.22	0.25	-0.3	1.22	-0.25	0.3
0	-0.64	0.16	-0.31	0.64	-0.16	0.31
0	-0.63	0.07	-0.39	0.63	-0.07	0.39
0	-0.68	0.16	-0.26	0.68	-0.16	0.26
0	-0.71	0.23	-0.24	0.71	-0.23	0.24
0	-0.8	0.22	-0.07	0.8	-0.22	0.07
0	-0.74	0.22	0.06	0.74	-0.22	-0.06
0	-0.65	0.11	0.22	0.65	-0.11	-0.22
0	-0.52	0.05	0.22	0.52	-0.05	-0.22
0	-0.38	0.02	0.27	0.38	-0.02	-0.27
0	-0.31	-0.01	0.33	0.31	0.01	-0.33
0	-0.28	-0.11	0.41	0.28	0.11	-0.41
0	-0.25	-0.12	0.44	0.25	0.12	-0.44
0	-0.18	-0.13	0.42	0.18	0.13	-0.42
0	-0.08	-0.08	0.43	0.08	0.08	-0.43
0	-0.08	-0.11	0.37	0.08	0.11	-0.37
0	-0.03	-0.06	0.34	0.03	0.06	-0.34
0	0.06	-0.04	0.37	-0.06	0.04	-0.37
0	0.06	-0.02	0.39	-0.06	0.02	-0.39
0	0.03	0.02	0.31	-0.03	-0.02	-0.31
0	0.06	-0.02	0.36	-0.06	0.02	-0.36
0	0.04	-0.03	0.43	-0.04	0.03	-0.43
0	0.05	0.02	0.45	-0.05	-0.02	-0.45
0	0.06	0.05	0.41	-0.06	-0.05	-0.41
0	0.12	0.06	0.4	-0.12	-0.06	-0.4
0	0.08	0.08	0.41	-0.08	-0.08	-0.41
0	0.06	0.09	0.37	-0.06	-0.09	-0.37
0	0.05	0.05	0.28	-0.05	-0.05	-0.28
0	0.07	0.02	0.31	-0.07	-0.02	-0.31
0	0.11	-0.05	0.33	-0.11	0.05	-0.33

0	0.16	-0.06	0.33	-0.16	0.06	-0.33
0	0.17	-0.02	0.38	-0.17	0.02	-0.38
0	0.14	-0.03	0.41	-0.14	0.03	-0.41
0	0	-0.19	0.47	0	0.19	-0.47
0	0.11	-0.55	0.51	-0.11	0.55	-0.51
0	0.33	-0.63	0.43	-0.33	0.63	-0.43
0	0.23	-0.74	0.34	-0.23	0.74	-0.34
0	0.37	-0.23	0.37	-0.37	0.23	-0.37
0	-0.22	0.95	0.4	0.22	-0.95	-0.4
0	-0.35	1.66	0.77	0.35	-1.66	-0.77
0	-0.61	1.58	0.78	0.61	-1.58	-0.78
0	-0.56	0.89	0.41	0.56	-0.89	-0.41
0	-0.41	0.28	0.04	0.41	-0.28	-0.04
0	0.72	-0.14	-0.07	-0.72	0.14	0.07
0	1.65	0.18	0.1	-1.65	-0.18	-0.1
0	1.59	0.71	0.51	-1.59	-0.71	-0.51
0	0.2	0.74	0.53	-0.2	-0.74	-0.53
0	-1.58	0.94	0.23	1.58	-0.94	-0.23
0	-0.63	-0.27	0.54	0.63	0.27	-0.54
0	0.39	-0.25	0.7	-0.39	0.25	-0.7
0	1.42	-0.45	0.84	-1.42	0.45	-0.84
0	2.69	-0.55	1.04	-2.69	0.55	-1.04
0	2.65	-0.67	1.21	-2.65	0.67	-1.21
0	1.77	-0.3	0.97	-1.77	0.3	-0.97
0	0.57	0.49	0.56	-0.57	-0.49	-0.56
0	-0.54	1.11	0.08	0.54	-1.11	-0.08
0	-0.6	0.9	-0.25	0.6	-0.9	0.25
0	0.64	0.14	0.07	-0.64	-0.14	-0.07
0	2.17	-1.13	0.64	-2.17	1.13	-0.64
0	2.31	-1.36	0.83	-2.31	1.36	-0.83
0	0.67	-0.65	0.51	-0.67	0.65	-0.51
0	-0.64	0.29	0.2	0.64	-0.29	-0.2
0	-0.92	0.34	-0.26	0.92	-0.34	0.26
0	0.19	-0.27	-0.11	-0.19	0.27	0.11
0	1.44	-0.95	0.4	-1.44	0.95	-0.4
0	1.84	-1.23	0.99	-1.84	1.23	-0.99
0	2.4	-0.53	1.32	-2.4	0.53	-1.32
0	2.38	-0.04	1.37	-2.38	0.04	-1.37
0	1.76	-0.51	0.86	-1.76	0.51	-0.86
0	0.93	-0.73	0.43	-0.93	0.73	-0.43
0	-0.22	-0.35	0.29	0.22	0.35	-0.29
0	-1.15	0.47	0.43	1.15	-0.47	-0.43

0	-1.17	1.19	0.45	1.17	-1.19	-0.45
0	-0.77	0.86	0.02	0.77	-0.86	-0.02
0	0.05	0.19	0.01	-0.05	-0.19	-0.01
0	1.27	-0.86	0.26	-1.27	0.86	-0.26
0	1.59	-1.02	0.55	-1.59	1.02	-0.55
0	0.65	-0.16	0.65	-0.65	0.16	-0.65
0	-0.68	0.67	0.48	0.68	-0.67	-0.48
0	-0.96	0.7	0.32	0.96	-0.7	-0.32
0	-0.6	0.21	0.62	0.6	-0.21	-0.62
0	0.33	-0.18	1.77	-0.33	0.18	-1.77
0	1.56	-0.8	2.21	-1.56	0.8	-2.21
0	1.32	-0.94	0.95	-1.32	0.94	-0.95
0	-0.64	0.16	-0.11	0.64	-0.16	0.11
0	-1.95	1.17	-0.18	1.95	-1.17	0.18
0	-1.2	0.69	0.09	1.2	-0.69	-0.09
0	0.54	-0.51	0.62	-0.54	0.51	-0.62
0	1.2	-0.97	0.68	-1.2	0.97	-0.68
0	0.31	-0.17	0.5	-0.31	0.17	-0.5
0	-0.07	0.49	0.26	0.07	-0.49	-0.26
0	0.69	0.11	0.17	-0.69	-0.11	-0.17
0	1	-0.59	-0.08	-1	0.59	0.08
0	0.51	-0.33	-0.13	-0.51	0.33	0.13
0	-0.4	0.87	-0.18	0.4	-0.87	0.18
0	-0.93	1.65	0.06	0.93	-1.65	-0.06
0	-0.07	0.93	0.2	0.07	-0.93	-0.2
0	1.08	-0.55	0.15	-1.08	0.55	-0.15
0	1.32	-0.76	0.17	-1.32	0.76	-0.17
0	0.06	0.35	0.05	-0.06	-0.35	-0.05
0	-1.13	1.39	-0.09	1.13	-1.39	0.09
0	-1.09	1.15	0.26	1.09	-1.15	-0.26
0	0.21	-0.24	0.58	-0.21	0.24	-0.58
0	1.97	-1.29	0.91	-1.97	1.29	-0.91
0	2.29	-1.78	0.72	-2.29	1.78	-0.72
0	0.65	-0.87	0.27	-0.65	0.87	-0.27
0	-1.49	0.92	-0.06	1.49	-0.92	0.06
0	-1.95	1.81	-0.01	1.95	-1.81	0.01
0	-0.19	0.9	0.48	0.19	-0.9	-0.48
0	1.92	-1.29	0.74	-1.92	1.29	-0.74
0	2.47	-2.7	0.6	-2.47	2.7	-0.6
0	1.22	-1.57	0.45	-1.22	1.57	-0.45
0	-0.46	0.51	0.37	0.46	-0.51	-0.37
0	-1.15	1.44	0.47	1.15	-1.44	-0.47

0	-0.27	1.06	0.76	0.27	-1.06	-0.76
0	0.85	0.11	0.87	-0.85	-0.11	-0.87
0	0.76	-0.38	0.62	-0.76	0.38	-0.62
0	-0.46	0.42	0.11	0.46	-0.42	-0.11
0	-1.56	1.44	-0.13	1.56	-1.44	0.13
0	-0.91	1.48	0.1	0.91	-1.48	-0.1
0	0.87	0.26	0.56	-0.87	-0.26	-0.56
0	1.9	-1.8	0.66	-1.9	1.8	-0.66
0	1.66	-1.47	0.38	-1.66	1.47	-0.38
0	0.07	0.78	0.25	-0.07	-0.78	-0.25
0	-1.04	2.76	0.31	1.04	-2.76	-0.31
0	-1.35	2.42	0.39	1.35	-2.42	-0.39
0	-0.66	-0.16	0.3	0.66	0.16	-0.3
0	1.09	-1.49	0.06	-1.09	1.49	-0.06
0	1.62	-0.64	-0.02	-1.62	0.64	0.02
0	0.94	1.31	0.44	-0.94	-1.31	-0.44
0	-0.22	1.91	0.67	0.22	-1.91	-0.67
0	-0.87	0.48	0.36	0.87	-0.48	-0.36
0	0.2	-0.4	0.24	-0.2	0.4	-0.24
0	1.07	-0.28	0.55	-1.07	0.28	-0.55
0	1.06	0.24	0.77	-1.06	-0.24	-0.77
0	0.09	-0.13	0.66	-0.09	0.13	-0.66
0	-0.66	-1.19	0.19	0.66	1.19	-0.19
0	-0.12	-0.66	-0.14	0.12	0.66	0.14
0	0.39	0.74	0.47	-0.39	-0.74	-0.47
0	0.37	1.26	1.22	-0.37	-1.26	-1.22
0	-0.39	-0.61	0.83	0.39	0.61	-0.83
0	0.03	-1.77	0.27	-0.03	1.77	-0.27
0	1.09	-1.07	0.11	-1.09	1.07	-0.11
0	1.24	0.27	0.61	-1.24	-0.27	-0.61
0	0.31	0.16	0.84	-0.31	-0.16	-0.84
0	-0.76	-1.51	0.15	0.76	1.51	-0.15
0	0.07	-1.08	-0.56	-0.07	1.08	0.56
0	-0.11	0.06	-0.52	0.11	-0.06	0.52
0	-0.74	1.22	0.19	0.74	-1.22	-0.19
0	-0.83	1.26	0.56	0.83	-1.26	-0.56
0	-0.41	0.07	0.43	0.41	-0.07	-0.43
0	0.46	-1.3	0.28	-0.46	1.3	-0.28
0	1.4	-0.68	0.6	-1.4	0.68	-0.6
0	1.05	0.65	1.03	-1.05	-0.65	-1.03
0	-0.46	0.67	0.8	0.46	-0.67	-0.8
0	-1.38	-0.5	-0.04	1.38	0.5	0.04

0	-0.48	-0.64	-0.54	0.48	0.64	0.54
0	0.83	0.11	-0.15	-0.83	-0.11	0.15
0	1.22	0.4	0.56	-1.22	-0.4	-0.56
0	0.5	-0.57	1.11	-0.5	0.57	-1.11
0	-0.01	-1.71	1.03	0.01	1.71	-1.03
0	1.03	-0.58	0.47	-1.03	0.58	-0.47
0	0.98	0.86	0.22	-0.98	-0.86	-0.22
0	0.08	1.31	0.34	-0.08	-1.31	-0.34
0	-0.7	-0.16	0.31	0.7	0.16	-0.31
0	-0.31	-1.51	-0.02	0.31	1.51	0.02
0	0.13	-1.93	-0.47	-0.13	1.93	0.47
0	0.77	-0.41	-0.25	-0.77	0.41	0.25
0	1.03	1.36	0.47	-1.03	-1.36	-0.47
0	-0.24	1.02	0.93	0.24	-1.02	-0.93
0	-1.26	-0.19	0.65	1.26	0.19	-0.65
0	-0.61	-0.22	0.08	0.61	0.22	-0.08
0	0.22	0.41	-0.04	-0.22	-0.41	0.04
0	1.17	1.72	0.15	-1.17	-1.72	-0.15
0	0.29	1.27	0.67	-0.29	-1.27	-0.67
0	-1.18	-0.95	0.89	1.18	0.95	-0.89
0	-0.64	-1.78	0.39	0.64	1.78	-0.39
0	0.34	-1.15	0.22	-0.34	1.15	-0.22
0	0.59	0.44	0.49	-0.59	-0.44	-0.49
0	0.25	1.68	0.75	-0.25	-1.68	-0.75
0	-0.53	0.8	0.76	0.53	-0.8	-0.76
0	-0.78	-1.24	0.46	0.78	1.24	-0.46
0	0.13	-1.89	-0.14	-0.13	1.89	0.14
0	1.41	0.01	0.08	-1.41	-0.01	-0.08
0	1.75	2.21	0.76	-1.75	-2.21	-0.76
0	0.31	1.92	1.4	-0.31	-1.92	-1.4
0	-1.76	-1.12	0.71	1.76	1.12	-0.71
0	-0.77	-1.87	-0.7	0.77	1.87	0.7
0	0.2	-1.19	-0.68	-0.2	1.19	0.68
0	0.86	0.71	0.37	-0.86	-0.71	-0.37
0	0.88	1.91	1.6	-0.88	-1.91	-1.6
0	0.77	1.85	1.64	-0.77	-1.85	-1.64
0	-0.2	-0.38	0.47	0.2	0.38	-0.47
0	-0.41	-1.55	-1.1	0.41	1.55	1.1
0	-0.28	-0.58	-1.67	0.28	0.58	1.67
0	-0.12	2.05	-0.61	0.12	-2.05	0.61
0	-0.42	3.56	1.13	0.42	-3.56	-1.13
0	-0.79	2.16	1.69	0.79	-2.16	-1.69

0	-0.16	-0.13	0.79	0.16	0.13	-0.79
0	0.28	-1.43	-0.15	-0.28	1.43	0.15
0	0.46	-0.2	-0.39	-0.46	0.2	0.39
0	0.54	2.06	0.02	-0.54	-2.06	-0.02
0	0.26	2.39	1.18	-0.26	-2.39	-1.18
0	0.29	0.14	1.54	-0.29	-0.14	-1.54
0	1.03	-2.3	0.83	-1.03	2.3	-0.83
0	0.91	-3.4	-0.41	-0.91	3.4	0.41
0	0.05	-1.46	-1.01	-0.05	1.46	1.01
0	-1.1	1.69	-0.71	1.1	-1.69	0.71
0	-2.29	3.33	0.2	2.29	-3.33	-0.2
0	-1.73	2.53	0.77	1.73	-2.53	-0.77
0	-0.88	0.51	0.34	0.88	-0.51	-0.34
0	-0.44	-0.61	-0.69	0.44	0.61	0.69
0	-1.29	-0.51	-1.5	1.29	0.51	1.5
0	-1.58	0.97	-1.08	1.58	-0.97	1.08
0	-0.74	1.67	0.65	0.74	-1.67	-0.65
0	1.11	0.8	2.3	-1.11	-0.8	-2.3
0	2.6	-1.56	2.07	-2.6	1.56	-2.07
0	1.95	-2.62	0.64	-1.95	2.62	-0.64
0	-0.32	-1.8	-0.93	0.32	1.8	0.93
0	-2.54	0.54	-1.28	2.54	-0.54	1.28
0	-2.7	2.11	-0.4	2.7	-2.11	0.4
0	-0.98	1.88	1.06	0.98	-1.88	-1.06
0	1.19	-0.28	1.72	-1.19	0.28	-1.72
0	2.33	-2.37	1.11	-2.33	2.37	-1.11
0	1.43	-2.07	-0.31	-1.43	2.07	0.31
0	-1.21	0.04	-0.57	1.21	-0.04	0.57
0	-2.84	2.02	-0.38	2.84	-2.02	0.38
0	-1.76	2.06	0.64	1.76	-2.06	-0.64
0	0.89	0.55	1.82	-0.89	-0.55	-1.82
0	2.77	-1.52	1.7	-2.77	1.52	-1.7
0	1.82	-1.5	0.17	-1.82	1.5	-0.17
0	-0.98	0.23	-0.49	0.98	-0.23	0.49
0	-2.33	2.31	-0.07	2.33	-2.31	0.07
0	-1	2.1	0.9	1	-2.1	-0.9
0	1.57	0.29	1.77	-1.57	-0.29	-1.77
0	2.4	-1.2	0.6	-2.4	1.2	-0.6
0	0.45	-0.85	-0.58	-0.45	0.85	0.58
0	-1.77	0.93	-0.31	1.77	-0.93	0.31
0	-1.76	1.06	0.58	1.76	-1.06	-0.58
0	0.55	-0.8	1.2	-0.55	0.8	-1.2

0	2.27	-2.24	1.03	-2.27	2.24	-1.03
0	1.49	-1.42	0.64	-1.49	1.42	-0.64
0	-0.38	1.08	0.77	0.38	-1.08	-0.77
0	-0.98	1.68	1.38	0.98	-1.68	-1.38
0	-0.42	0.54	0.71	0.42	-0.54	-0.71
0	-0.95	0.56	0.43	0.95	-0.56	-0.43
0	-0.93	1.4	0.78	0.93	-1.4	-0.78
0	0.21	-0.18	1.04	-0.21	0.18	-1.04
0	1.7	-2.66	0.67	-1.7	2.66	-0.67
0	2.27	-3.77	0.87	-2.27	3.77	-0.87
0	1.55	-2.48	1.31	-1.55	2.48	-1.31
0	0.1	-0.4	1.13	-0.1	0.4	-1.13
0	-1.09	1.11	0.97	1.09	-1.11	-0.97
0	-1.41	0.8	0.43	1.41	-0.8	-0.43
0	-0.73	-0.29	0.1	0.73	0.29	-0.1
0	-0.17	-1.62	-0.06	0.17	1.62	0.06
0	1.2	-0.47	0.03	-1.2	0.47	-0.03
0	0	0.7	0.56	0	-0.7	-0.56
0	-0.9	2.46	0.39	0.9	-2.46	-0.39
0	1.02	2.3	0.11	-1.02	-2.3	-0.11
0	1.43	4.62	-0.23	-1.43	-4.62	0.23
0	1.26	3.8	-0.29	-1.26	-3.8	0.29
0	0.97	2.96	-0.25	-0.97	-2.96	0.25
0	0.79	2.2	-0.14	-0.79	-2.2	0.14
0	0.77	1.89	-0.02	-0.77	-1.89	0.02
0	0.99	1.97	0.03	-0.99	-1.97	-0.03
0	0.89	1.64	0.16	-0.89	-1.64	-0.16
0	0.91	1.32	0.37	-0.91	-1.32	-0.37
0	0.74	1.05	0.29	-0.74	-1.05	-0.29
0	0.65	0.89	0.24	-0.65	-0.89	-0.24
0	0.59	0.66	0.2	-0.59	-0.66	-0.2
0	0.55	0.55	0.26	-0.55	-0.55	-0.26
0	0.53	0.5	0.23	-0.53	-0.5	-0.23
0	0.46	0.47	0.32	-0.46	-0.47	-0.32
0	0.41	0.42	0.28	-0.41	-0.42	-0.28
0	0.35	0.39	0.38	-0.35	-0.39	-0.38
0	0.32	0.36	0.38	-0.32	-0.36	-0.38
0	0.3	0.34	0.35	-0.3	-0.34	-0.35
0	0.26	0.32	0.4	-0.26	-0.32	-0.4
0	0.23	0.24	0.37	-0.23	-0.24	-0.37
0	0.19	0.23	0.39	-0.19	-0.23	-0.39
0	0.21	0.21	0.37	-0.21	-0.21	-0.37

0	0.21	0.2	0.38	-0.21	-0.2	-0.38
0	0.24	0.16	0.44	-0.24	-0.16	-0.44
0	0.21	0.16	0.42	-0.21	-0.16	-0.42
0	0.2	0.1	0.47	-0.2	-0.1	-0.47
0	0.25	0.1	0.46	-0.25	-0.1	-0.46
0	0.22	0.11	0.54	-0.22	-0.11	-0.54
0	0.24	0.14	0.57	-0.24	-0.14	-0.57
0	0.21	0.13	0.55	-0.21	-0.13	-0.55
0	0.24	0.18	0.56	-0.24	-0.18	-0.56
0	0.21	0.1	0.59	-0.21	-0.1	-0.59
0	0.19	0.13	0.58	-0.19	-0.13	-0.58
0	0.25	0.12	0.55	-0.25	-0.12	-0.55
0	0.27	0.11	0.54	-0.27	-0.11	-0.54
0	0.24	0.12	0.56	-0.24	-0.12	-0.56
0	0.28	0.13	0.49	-0.28	-0.13	-0.49
0	0.27	0.11	0.48	-0.27	-0.11	-0.48
0	0.29	0.11	0.44	-0.29	-0.11	-0.44
0	0.26	0.11	0.44	-0.26	-0.11	-0.44
0	0.26	0.13	0.45	-0.26	-0.13	-0.45
0	0.24	0.13	0.44	-0.24	-0.13	-0.44
0	0.22	0.12	0.44	-0.22	-0.12	-0.44
0	0.25	0.12	0.38	-0.25	-0.12	-0.38
0	0.28	0.15	0.32	-0.28	-0.15	-0.32
0	0.27	0.18	0.3	-0.27	-0.18	-0.3
0	0.23	0.17	0.31	-0.23	-0.17	-0.31
0	0.25	0.13	0.35	-0.25	-0.13	-0.35
0	0.28	0.09	0.44	-0.28	-0.09	-0.44
0	0.28	0.09	0.48	-0.28	-0.09	-0.48
0	0.26	0.13	0.44	-0.26	-0.13	-0.44
0	0.26	0.13	0.47	-0.26	-0.13	-0.47
0	0.26	0.14	0.46	-0.26	-0.14	-0.46
0	0.26	0.18	0.37	-0.26	-0.18	-0.37
0	0.27	0.18	0.41	-0.27	-0.18	-0.41
0	0.27	0.17	0.36	-0.27	-0.17	-0.36
0	0.28	0.18	0.35	-0.28	-0.18	-0.35
0	0.24	0.17	0.39	-0.24	-0.17	-0.39
0	0.26	0.19	0.4	-0.26	-0.19	-0.4
0	0.26	0.18	0.45	-0.26	-0.18	-0.45
0	0.24	0.17	0.46	-0.24	-0.17	-0.46
0	0.22	0.14	0.49	-0.22	-0.14	-0.49
0	0.21	0.14	0.46	-0.21	-0.14	-0.46
0	0.17	0.15	0.53	-0.17	-0.15	-0.53

0	0.23	0.15	0.5	-0.23	-0.15	-0.5
0	0.25	0.13	0.43	-0.25	-0.13	-0.43
0	0.24	0.13	0.39	-0.24	-0.13	-0.39
0	0.22	0.1	0.37	-0.22	-0.1	-0.37
0	0.18	0.1	0.33	-0.18	-0.1	-0.33
0	0.22	0.09	0.35	-0.22	-0.09	-0.35
0	0.27	0.08	0.41	-0.27	-0.08	-0.41
0	0.25	0.1	0.45	-0.25	-0.1	-0.45
0	0.26	0.1	0.46	-0.26	-0.1	-0.46
0	0.26	0.09	0.49	-0.26	-0.09	-0.49
0	0.23	0.11	0.58	-0.23	-0.11	-0.58
0	0.22	0.11	0.57	-0.22	-0.11	-0.57
0	0.22	0.1	0.55	-0.22	-0.1	-0.55
0	0.22	0.09	0.49	-0.22	-0.09	-0.49
0	0.22	0.06	0.48	-0.22	-0.06	-0.48
0	0.24	0.08	0.48	-0.24	-0.08	-0.48
0	0.21	0.11	0.46	-0.21	-0.11	-0.46
0	0.24	0.07	0.39	-0.24	-0.07	-0.39
0	0.22	0.11	0.42	-0.22	-0.11	-0.42
0	0.21	0.11	0.32	-0.21	-0.11	-0.32
0	0.23	0.09	0.34	-0.23	-0.09	-0.34
0	0.23	0.1	0.27	-0.23	-0.1	-0.27
0	0.23	0.15	0.32	-0.23	-0.15	-0.32
0	0.24	0.12	0.41	-0.24	-0.12	-0.41
0	0.18	0.12	0.41	-0.18	-0.12	-0.41
0	0.19	0.12	0.4	-0.19	-0.12	-0.4
0	0.19	0.1	0.45	-0.19	-0.1	-0.45
0	0.23	0.14	0.46	-0.23	-0.14	-0.46
0	0.21	0.16	0.39	-0.21	-0.16	-0.39
0	0.21	0.14	0.3	-0.21	-0.14	-0.3
0	0.19	0.13	0.27	-0.19	-0.13	-0.27
0	0.21	0.16	0.35	-0.21	-0.16	-0.35
0	0.19	0.12	0.44	-0.19	-0.12	-0.44
0	0.22	0.12	0.44	-0.22	-0.12	-0.44
0	0.2	0.14	0.38	-0.2	-0.14	-0.38
0	0.23	0.13	0.37	-0.23	-0.13	-0.37
0	0.26	0.12	0.32	-0.26	-0.12	-0.32
0	0.24	0.15	0.33	-0.24	-0.15	-0.33
0	0.19	0.14	0.32	-0.19	-0.14	-0.32
0	0.14	0.15	0.37	-0.14	-0.15	-0.37
0	0.12	0.17	0.28	-0.12	-0.17	-0.28
0	0.14	0.15	0.27	-0.14	-0.15	-0.27

0	0.18	0.15	0.27	-0.18	-0.15	-0.27
0	0.19	0.14	0.28	-0.19	-0.14	-0.28
0	0.18	0.13	0.27	-0.18	-0.13	-0.27
0	0.19	0.14	0.26	-0.19	-0.14	-0.26
0	0.18	0.12	0.31	-0.18	-0.12	-0.31
0	0.18	0.12	0.36	-0.18	-0.12	-0.36
0	0.25	0.12	0.36	-0.25	-0.12	-0.36
0	0.27	0.07	0.31	-0.27	-0.07	-0.31
0	0.27	0.06	0.34	-0.27	-0.06	-0.34
0	0.21	0.08	0.4	-0.21	-0.08	-0.4
0	0.17	0.09	0.36	-0.17	-0.09	-0.36
0	0.16	0.08	0.27	-0.16	-0.08	-0.27
0	0.18	0.07	0.34	-0.18	-0.07	-0.34
0	0.22	0.1	0.35	-0.22	-0.1	-0.35
0	0.2	0.1	0.35	-0.2	-0.1	-0.35
0	0.19	0.13	0.41	-0.19	-0.13	-0.41
0	0.2	0.11	0.38	-0.2	-0.11	-0.38
0	0.2	0.17	0.35	-0.2	-0.17	-0.35
0	0.2	0.14	0.41	-0.2	-0.14	-0.41
0	0.17	0.1	0.44	-0.17	-0.1	-0.44
0	0.2	0.06	0.44	-0.2	-0.06	-0.44
0	0.2	0.07	0.41	-0.2	-0.07	-0.41
0	0.25	0.08	0.39	-0.25	-0.08	-0.39
0	0.33	0.06	0.44	-0.33	-0.06	-0.44
0	0.34	0.08	0.4	-0.34	-0.08	-0.4
0	0.31	0.12	0.39	-0.31	-0.12	-0.39
0	0.31	0.12	0.37	-0.31	-0.12	-0.37
0	0.3	0.13	0.38	-0.3	-0.13	-0.38
0	0.26	0.12	0.44	-0.26	-0.12	-0.44
0	0.28	0.14	0.46	-0.28	-0.14	-0.46
0	0.33	0.1	0.46	-0.33	-0.1	-0.46
0	0.32	0.07	0.48	-0.32	-0.07	-0.48
0	0.27	0.06	0.38	-0.27	-0.06	-0.38
0	0.28	0.06	0.39	-0.28	-0.06	-0.39
0	0.32	0.09	0.36	-0.32	-0.09	-0.36
0	0.31	0.08	0.39	-0.31	-0.08	-0.39
0	0.31	0.08	0.34	-0.31	-0.08	-0.34
0	0.29	0.06	0.31	-0.29	-0.06	-0.31
0	0.26	0.07	0.28	-0.26	-0.07	-0.28
0	0.27	0.07	0.26	-0.27	-0.07	-0.26
0	0.3	0.1	0.26	-0.3	-0.1	-0.26
0	0.27	0.13	0.26	-0.27	-0.13	-0.26

0	0.28	0.13	0.23	-0.28	-0.13	-0.23
0	0.27	0.13	0.24	-0.27	-0.13	-0.24
0	0.22	0.16	0.29	-0.22	-0.16	-0.29
0	0.21	0.17	0.37	-0.21	-0.17	-0.37
0	0.21	0.2	0.35	-0.21	-0.2	-0.35
0	0.2	0.17	0.34	-0.2	-0.17	-0.34
0	0.24	0.16	0.32	-0.24	-0.16	-0.32
0	0.21	0.17	0.33	-0.21	-0.17	-0.33
0	0.17	0.17	0.33	-0.17	-0.17	-0.33
0	0.19	0.15	0.33	-0.19	-0.15	-0.33
0	0.22	0.13	0.38	-0.22	-0.13	-0.38
0	0.21	0.13	0.35	-0.21	-0.13	-0.35
0	0.2	0.16	0.28	-0.2	-0.16	-0.28
0	0.25	0.16	0.29	-0.25	-0.16	-0.29
0	0.28	0.14	0.3	-0.28	-0.14	-0.3
0	0.32	0.11	0.31	-0.32	-0.11	-0.31
0	0.25	0.12	0.28	-0.25	-0.12	-0.28
0	0.28	0.12	0.24	-0.28	-0.12	-0.24
0	0.27	0.08	0.26	-0.27	-0.08	-0.26
0	0.24	0.08	0.31	-0.24	-0.08	-0.31
0	0.22	0.12	0.31	-0.22	-0.12	-0.31
0	0.22	0.14	0.35	-0.22	-0.14	-0.35
0	0.22	0.17	0.35	-0.22	-0.17	-0.35
0	0.23	0.15	0.38	-0.23	-0.15	-0.38
0	0.28	0.14	0.41	-0.28	-0.14	-0.41
0	0.26	0.15	0.33	-0.26	-0.15	-0.33
0	0.22	0.12	0.36	-0.22	-0.12	-0.36
0	0.22	0.15	0.43	-0.22	-0.15	-0.43
0	0.24	0.18	0.41	-0.24	-0.18	-0.41
0	0.23	0.14	0.38	-0.23	-0.14	-0.38
0	0.22	0.17	0.39	-0.22	-0.17	-0.39
0	0.27	0.14	0.37	-0.27	-0.14	-0.37
0	0.25	0.15	0.48	-0.25	-0.15	-0.48
0	0.25	0.17	0.46	-0.25	-0.17	-0.46
0	0.23	0.14	0.46	-0.23	-0.14	-0.46
0	0.26	0.14	0.44	-0.26	-0.14	-0.44
0	0.28	0.13	0.53	-0.28	-0.13	-0.53
0	0.24	0.12	0.5	-0.24	-0.12	-0.5
0	0.23	0.11	0.46	-0.23	-0.11	-0.46
0	0.23	0.11	0.5	-0.23	-0.11	-0.5
0	0.22	0.16	0.49	-0.22	-0.16	-0.49
0	0.21	0.19	0.49	-0.21	-0.19	-0.49

0	0.16	0.21	0.42	-0.16	-0.21	-0.42
0	0.17	0.17	0.38	-0.17	-0.17	-0.38
0	0.2	0.18	0.39	-0.2	-0.18	-0.39
0	0.21	0.16	0.41	-0.21	-0.16	-0.41
0	0.24	0.17	0.37	-0.24	-0.17	-0.37
0	0.22	0.14	0.37	-0.22	-0.14	-0.37
0	0.2	0.16	0.41	-0.2	-0.16	-0.41
0	0.21	0.11	0.38	-0.21	-0.11	-0.38
0	0.24	0.14	0.44	-0.24	-0.14	-0.44
0	0.22	0.12	0.4	-0.22	-0.12	-0.4
0	0.24	0.11	0.44	-0.24	-0.11	-0.44
0	0.23	0.16	0.45	-0.23	-0.16	-0.45
0	0.24	0.16	0.41	-0.24	-0.16	-0.41
0	0.16	0.16	0.37	-0.16	-0.16	-0.37
0	0.13	0.19	0.28	-0.13	-0.19	-0.28
0	0.15	0.17	0.34	-0.15	-0.17	-0.34
0	0.14	0.13	0.31	-0.14	-0.13	-0.31
0	0.17	0.13	0.31	-0.17	-0.13	-0.31
0	0.24	0.08	0.28	-0.24	-0.08	-0.28
0	0.23	0.12	0.19	-0.23	-0.12	-0.19
0	0.28	0.14	0.22	-0.28	-0.14	-0.22
0	0.29	0.15	0.27	-0.29	-0.15	-0.27
0	0.34	0.12	0.35	-0.34	-0.12	-0.35
0	0.37	0.18	0.35	-0.37	-0.18	-0.35
0	0.35	0.15	0.36	-0.35	-0.15	-0.36
0	0.33	0.19	0.41	-0.33	-0.19	-0.41
0	0.32	0.17	0.4	-0.32	-0.17	-0.4
0	0.32	0.13	0.39	-0.32	-0.13	-0.39
0	0.28	0.19	0.41	-0.28	-0.19	-0.41
0	0.31	0.2	0.44	-0.31	-0.2	-0.44
0	0.35	0.2	0.44	-0.35	-0.2	-0.44
0	0.32	0.15	0.43	-0.32	-0.15	-0.43
0	0.35	0.16	0.4	-0.35	-0.16	-0.4
0	0.34	0.16	0.43	-0.34	-0.16	-0.43
0	0.34	0.14	0.38	-0.34	-0.14	-0.38
0	0.29	0.16	0.39	-0.29	-0.16	-0.39
0	0.32	0.15	0.46	-0.32	-0.15	-0.46
0	0.31	0.16	0.49	-0.31	-0.16	-0.49
0	0.29	0.15	0.43	-0.29	-0.15	-0.43
0	0.33	0.13	0.38	-0.33	-0.13	-0.38
0	0.32	0.16	0.38	-0.32	-0.16	-0.38
0	0.3	0.14	0.44	-0.3	-0.14	-0.44

0	0.31	0.18	0.33	-0.31	-0.18	-0.33
0	0.31	0.2	0.23	-0.31	-0.2	-0.23
0	0.29	0.19	0.27	-0.29	-0.19	-0.27
0	0.28	0.14	0.27	-0.28	-0.14	-0.27
0	0.26	0.12	0.23	-0.26	-0.12	-0.23
0	0.24	0.16	0.23	-0.24	-0.16	-0.23
0	0.25	0.15	0.27	-0.25	-0.15	-0.27
0	0.23	0.15	0.33	-0.23	-0.15	-0.33
0	0.19	0.18	0.28	-0.19	-0.18	-0.28
0	0.17	0.14	0.3	-0.17	-0.14	-0.3
0	0.21	0.1	0.37	-0.21	-0.1	-0.37
0	0.16	0.09	0.4	-0.16	-0.09	-0.4
0	0.21	0.1	0.46	-0.21	-0.1	-0.46
0	0.18	0.11	0.51	-0.18	-0.11	-0.51
0	0.18	0.13	0.51	-0.18	-0.13	-0.51
0	0.21	0.12	0.52	-0.21	-0.12	-0.52
0	0.19	0.11	0.55	-0.19	-0.11	-0.55
0	0.16	0.09	0.51	-0.16	-0.09	-0.51
0	0.21	0.1	0.51	-0.21	-0.1	-0.51
0	0.21	0.08	0.49	-0.21	-0.08	-0.49
0	0.23	0.05	0.47	-0.23	-0.05	-0.47
0	0.21	0.04	0.49	-0.21	-0.04	-0.49
0	0.18	0.08	0.51	-0.18	-0.08	-0.51
0	0.17	0.1	0.46	-0.17	-0.1	-0.46
0	0.17	0.1	0.47	-0.17	-0.1	-0.47
0	0.22	0.14	0.5	-0.22	-0.14	-0.5
0	0.21	0.15	0.44	-0.21	-0.15	-0.44
0	0.24	0.17	0.51	-0.24	-0.17	-0.51
0	0.24	0.2	0.48	-0.24	-0.2	-0.48
0	0.2	0.18	0.45	-0.2	-0.18	-0.45
0	0.22	0.2	0.53	-0.22	-0.2	-0.53
0	0.24	0.18	0.49	-0.24	-0.18	-0.49
0	0.24	0.17	0.44	-0.24	-0.17	-0.44
0	0.23	0.19	0.41	-0.23	-0.19	-0.41
0	0.22	0.16	0.49	-0.22	-0.16	-0.49
0	0.24	0.11	0.52	-0.24	-0.11	-0.52
0	0.23	0.12	0.46	-0.23	-0.12	-0.46
0	0.16	0.09	0.44	-0.16	-0.09	-0.44
0	0.18	0.1	0.48	-0.18	-0.1	-0.48
0	0.18	0.15	0.49	-0.18	-0.15	-0.49
0	0.22	0.15	0.44	-0.22	-0.15	-0.44
0	0.21	0.17	0.39	-0.21	-0.17	-0.39

0	0.19	0.19	0.39	-0.19	-0.19	-0.39
0	0.18	0.18	0.32	-0.18	-0.18	-0.32
0	0.18	0.15	0.33	-0.18	-0.15	-0.33
0	0.2	0.14	0.33	-0.2	-0.14	-0.33
0	0.19	0.14	0.34	-0.19	-0.14	-0.34
0	0.21	0.13	0.35	-0.21	-0.13	-0.35
0	0.24	0.12	0.37	-0.24	-0.12	-0.37
0	0.22	0.15	0.34	-0.22	-0.15	-0.34
0	0.25	0.15	0.36	-0.25	-0.15	-0.36
0	0.23	0.2	0.36	-0.23	-0.2	-0.36
0	0.2	0.18	0.36	-0.2	-0.18	-0.36
0	0.26	0.19	0.36	-0.26	-0.19	-0.36
0	0.28	0.19	0.41	-0.28	-0.19	-0.41
0	0.29	0.18	0.44	-0.29	-0.18	-0.44
0	0.28	0.16	0.43	-0.28	-0.16	-0.43
0	0.25	0.14	0.48	-0.25	-0.14	-0.48
0	0.24	0.17	0.46	-0.24	-0.17	-0.46
0	0.25	0.19	0.34	-0.25	-0.19	-0.34
0	0.24	0.23	0.31	-0.24	-0.23	-0.31
0	0.25	0.19	0.3	-0.25	-0.19	-0.3
0	0.29	0.19	0.33	-0.29	-0.19	-0.33
0	0.29	0.17	0.33	-0.29	-0.17	-0.33
0	0.3	0.15	0.37	-0.3	-0.15	-0.37
0	0.29	0.15	0.41	-0.29	-0.15	-0.41
0	0.28	0.15	0.41	-0.28	-0.15	-0.41
0	0.3	0.17	0.41	-0.3	-0.17	-0.41
0	0.29	0.19	0.43	-0.29	-0.19	-0.43
0	0.29	0.15	0.45	-0.29	-0.15	-0.45
0	0.31	0.15	0.37	-0.31	-0.15	-0.37
0	0.28	0.15	0.33	-0.28	-0.15	-0.33
0	0.28	0.15	0.33	-0.28	-0.15	-0.33
0	0.29	0.13	0.29	-0.29	-0.13	-0.29
0	0.28	0.13	0.34	-0.28	-0.13	-0.34
0	0.24	0.12	0.33	-0.24	-0.12	-0.33
0	0.21	0.17	0.37	-0.21	-0.17	-0.37
0	0.19	0.15	0.33	-0.19	-0.15	-0.33
0	0.25	0.08	0.3	-0.25	-0.08	-0.3
0	0.28	0.09	0.3	-0.28	-0.09	-0.3
0	0.3	0.11	0.32	-0.3	-0.11	-0.32
0	0.27	0.06	0.35	-0.27	-0.06	-0.35
0	0.23	0.08	0.34	-0.23	-0.08	-0.34
0	0.24	0.09	0.35	-0.24	-0.09	-0.35

0	0.26	0.1	0.31	-0.26	-0.1	-0.31
0	0.28	0.13	0.26	-0.28	-0.13	-0.26
0	0.3	0.09	0.26	-0.3	-0.09	-0.26
0	0.36	0.11	0.24	-0.36	-0.11	-0.24
0	0.34	0.09	0.27	-0.34	-0.09	-0.27
0	0.29	0.13	0.25	-0.29	-0.13	-0.25
0	0.24	0.15	0.31	-0.24	-0.15	-0.31
0	0.23	0.13	0.3	-0.23	-0.13	-0.3
0	0.31	0.16	0.32	-0.31	-0.16	-0.32
0	0.32	0.16	0.34	-0.32	-0.16	-0.34
0	0.3	0.17	0.38	-0.3	-0.17	-0.38
0	0.26	0.16	0.37	-0.26	-0.16	-0.37
0	0.27	0.13	0.43	-0.27	-0.13	-0.43
0	0.32	0.08	0.45	-0.32	-0.08	-0.45
0	0.33	0.13	0.47	-0.33	-0.13	-0.47
0	0.37	0.17	0.43	-0.37	-0.17	-0.43
0	0.38	0.16	0.42	-0.38	-0.16	-0.42
0	0.33	0.13	0.38	-0.33	-0.13	-0.38
0	0.27	0.09	0.38	-0.27	-0.09	-0.38
0	0.25	0.06	0.46	-0.25	-0.06	-0.46
0	0.3	0.1	0.4	-0.3	-0.1	-0.4
0	0.31	0.13	0.39	-0.31	-0.13	-0.39
0	0.36	0.13	0.38	-0.36	-0.13	-0.38
0	0.38	0.13	0.38	-0.38	-0.13	-0.38
0	0.36	0.14	0.34	-0.36	-0.14	-0.34
0	0.31	0.12	0.37	-0.31	-0.12	-0.37
0	0.26	0.12	0.34	-0.26	-0.12	-0.34
0	0.34	0.1	0.34	-0.34	-0.1	-0.34
0	0.3	0.12	0.4	-0.3	-0.12	-0.4
0	0.31	0.12	0.4	-0.31	-0.12	-0.4
0	0.34	0.11	0.38	-0.34	-0.11	-0.38
0	0.33	0.08	0.37	-0.33	-0.08	-0.37
0	0.33	0.05	0.35	-0.33	-0.05	-0.35
0	0.33	0.04	0.33	-0.33	-0.04	-0.33
0	0.28	0.07	0.32	-0.28	-0.07	-0.32
0	0.28	0.05	0.32	-0.28	-0.05	-0.32
0	0.27	0.06	0.29	-0.27	-0.06	-0.29
0	0.24	0.08	0.29	-0.24	-0.08	-0.29
0	0.28	0.12	0.32	-0.28	-0.12	-0.32
0	0.27	0.13	0.23	-0.27	-0.13	-0.23
0	0.27	0.17	0.23	-0.27	-0.17	-0.23
0	0.29	0.12	0.21	-0.29	-0.12	-0.21

0	0.3	0.1	0.17	-0.3	-0.1	-0.17
0	0.31	0.16	0.19	-0.31	-0.16	-0.19
0	0.28	0.19	0.19	-0.28	-0.19	-0.19
0	0.3	0.17	0.24	-0.3	-0.17	-0.24
0	0.31	0.18	0.27	-0.31	-0.18	-0.27
0	0.31	0.16	0.22	-0.31	-0.16	-0.22
0	0.34	0.13	0.23	-0.34	-0.13	-0.23
0	0.33	0.07	0.31	-0.33	-0.07	-0.31
0	0.33	0.1	0.32	-0.33	-0.1	-0.32
0	0.34	0.09	0.32	-0.34	-0.09	-0.32
0	0.3	0.11	0.29	-0.3	-0.11	-0.29
0	0.27	0.13	0.33	-0.27	-0.13	-0.33
0	0.27	0.11	0.3	-0.27	-0.11	-0.3
0	0.26	0.12	0.35	-0.26	-0.12	-0.35
0	0.28	0.15	0.38	-0.28	-0.15	-0.38
0	0.27	0.13	0.35	-0.27	-0.13	-0.35
0	0.26	0.1	0.39	-0.26	-0.1	-0.39
0	0.25	0.12	0.4	-0.25	-0.12	-0.4
0	0.3	0.11	0.43	-0.3	-0.11	-0.43
0	0.27	0.14	0.37	-0.27	-0.14	-0.37
0	0.23	0.15	0.47	-0.23	-0.15	-0.47
0	0.25	0.15	0.5	-0.25	-0.15	-0.5
0	0.19	0.14	0.43	-0.19	-0.14	-0.43
0	0.23	0.14	0.46	-0.23	-0.14	-0.46
0	0.23	0.15	0.47	-0.23	-0.15	-0.47
0	0.25	0.14	0.42	-0.25	-0.14	-0.42
0	0.29	0.14	0.37	-0.29	-0.14	-0.37
0	0.25	0.15	0.37	-0.25	-0.15	-0.37
0	0.25	0.18	0.37	-0.25	-0.18	-0.37
0	0.28	0.16	0.39	-0.28	-0.16	-0.39
0	0.28	0.17	0.34	-0.28	-0.17	-0.34
0	0.25	0.19	0.38	-0.25	-0.19	-0.38
0	0.22	0.18	0.35	-0.22	-0.18	-0.35
0	0.23	0.15	0.41	-0.23	-0.15	-0.41
0	0.24	0.19	0.38	-0.24	-0.19	-0.38
0	0.28	0.2	0.34	-0.28	-0.2	-0.34
0	0.28	0.2	0.3	-0.28	-0.2	-0.3
0	0.26	0.19	0.27	-0.26	-0.19	-0.27
0	0.25	0.23	0.33	-0.25	-0.23	-0.33
0	0.24	0.19	0.39	-0.24	-0.19	-0.39
0	0.26	0.22	0.3	-0.26	-0.22	-0.3
0	0.27	0.19	0.29	-0.27	-0.19	-0.29

0	0.25	0.18	0.34	-0.25	-0.18	-0.34
0	0.27	0.2	0.27	-0.27	-0.2	-0.27
0	0.26	0.18	0.36	-0.26	-0.18	-0.36
0	0.29	0.18	0.33	-0.29	-0.18	-0.33
0	0.32	0.16	0.36	-0.32	-0.16	-0.36
0	0.29	0.15	0.38	-0.29	-0.15	-0.38
0	0.23	0.16	0.36	-0.23	-0.16	-0.36
0	0.25	0.17	0.34	-0.25	-0.17	-0.34
0	0.25	0.17	0.32	-0.25	-0.17	-0.32
0	0.27	0.19	0.27	-0.27	-0.19	-0.27
0	0.26	0.1	0.28	-0.26	-0.1	-0.28
0	0.32	0.11	0.29	-0.32	-0.11	-0.29
0	0.31	0.13	0.26	-0.31	-0.13	-0.26
0	0.31	0.12	0.3	-0.31	-0.12	-0.3
0	0.35	0.14	0.33	-0.35	-0.14	-0.33
0	0.31	0.13	0.35	-0.31	-0.13	-0.35
0	0.33	0.16	0.3	-0.33	-0.16	-0.3
0	0.37	0.13	0.27	-0.37	-0.13	-0.27
0	0.33	0.19	0.33	-0.33	-0.19	-0.33
0	0.34	0.18	0.31	-0.34	-0.18	-0.31
0	0.33	0.19	0.24	-0.33	-0.19	-0.24
0	0.33	0.18	0.33	-0.33	-0.18	-0.33
0	0.3	0.14	0.35	-0.3	-0.14	-0.35
0	0.26	0.17	0.37	-0.26	-0.17	-0.37
0	0.26	0.17	0.4	-0.26	-0.17	-0.4
0	0.22	0.13	0.35	-0.22	-0.13	-0.35
0	0.24	0.13	0.37	-0.24	-0.13	-0.37
0	0.24	0.16	0.37	-0.24	-0.16	-0.37
0	0.22	0.2	0.38	-0.22	-0.2	-0.38
0	0.24	0.19	0.4	-0.24	-0.19	-0.4
0	0.24	0.15	0.34	-0.24	-0.15	-0.34
0	0.22	0.12	0.4	-0.22	-0.12	-0.4
0	0.22	0.11	0.42	-0.22	-0.11	-0.42
0	0.23	0.07	0.37	-0.23	-0.07	-0.37
0	0.25	0.1	0.42	-0.25	-0.1	-0.42
0	0.21	0.13	0.39	-0.21	-0.13	-0.39
0	0.24	0.09	0.39	-0.24	-0.09	-0.39
0	0.23	0.09	0.3	-0.23	-0.09	-0.3
0	0.23	0.09	0.28	-0.23	-0.09	-0.28
0	0.28	0.12	0.28	-0.28	-0.12	-0.28
0	0.29	0.12	0.27	-0.29	-0.12	-0.27
0	0.32	0.1	0.23	-0.32	-0.1	-0.23

0	0.29	0.08	0.19	-0.29	-0.08	-0.19
0	0.27	0.1	0.17	-0.27	-0.1	-0.17
0	0.28	0.08	0.26	-0.28	-0.08	-0.26
0	0.25	0.09	0.25	-0.25	-0.09	-0.25
0	0.25	0.08	0.27	-0.25	-0.08	-0.27
0	0.26	0.04	0.25	-0.26	-0.04	-0.25
0	0.26	0.03	0.3	-0.26	-0.03	-0.3
0	0.28	0.06	0.31	-0.28	-0.06	-0.31
0	0.33	0.11	0.29	-0.33	-0.11	-0.29
0	0.31	0.09	0.29	-0.31	-0.09	-0.29
0	0.3	0.1	0.33	-0.3	-0.1	-0.33
0	0.29	0.16	0.29	-0.29	-0.16	-0.29
0	0.26	0.14	0.28	-0.26	-0.14	-0.28
0	0.27	0.1	0.34	-0.27	-0.1	-0.34
0	0.26	0.09	0.32	-0.26	-0.09	-0.32
0	0.26	0.09	0.34	-0.26	-0.09	-0.34
0	0.27	0.09	0.34	-0.27	-0.09	-0.34
0	0.27	0.1	0.34	-0.27	-0.1	-0.34
0	0.24	0.14	0.37	-0.24	-0.14	-0.37
0	0.27	0.15	0.32	-0.27	-0.15	-0.32
0	0.28	0.14	0.36	-0.28	-0.14	-0.36
0	0.27	0.15	0.38	-0.27	-0.15	-0.38
0	0.28	0.11	0.3	-0.28	-0.11	-0.3
0	0.3	0.09	0.3	-0.3	-0.09	-0.3
0	0.32	0.09	0.3	-0.32	-0.09	-0.3
0	0.24	0.08	0.24	-0.24	-0.08	-0.24
0	0.25	0.1	0.32	-0.25	-0.1	-0.32
0	0.27	0.12	0.36	-0.27	-0.12	-0.36
0	0.26	0.11	0.37	-0.26	-0.11	-0.37
0	0.27	0.15	0.37	-0.27	-0.15	-0.37
0	0.29	0.14	0.3	-0.29	-0.14	-0.3
0	0.28	0.13	0.35	-0.28	-0.13	-0.35
0	0.27	0.11	0.33	-0.27	-0.11	-0.33
0	0.28	0.07	0.36	-0.28	-0.07	-0.36
0	0.28	0.07	0.32	-0.28	-0.07	-0.32
0	0.28	0.02	0.39	-0.28	-0.02	-0.39
0	0.25	0.03	0.37	-0.25	-0.03	-0.37
0	0.25	0.05	0.41	-0.25	-0.05	-0.41
0	0.19	0.1	0.45	-0.19	-0.1	-0.45
0	0.23	0.07	0.49	-0.23	-0.07	-0.49
0	0.23	0.09	0.44	-0.23	-0.09	-0.44
0	0.19	0.06	0.46	-0.19	-0.06	-0.46

0	0.22	0.06	0.37	-0.22	-0.06	-0.37
0	0.22	0.1	0.37	-0.22	-0.1	-0.37
0	0.22	0.09	0.43	-0.22	-0.09	-0.43
0	0.22	0.1	0.39	-0.22	-0.1	-0.39
0	0.24	0.09	0.36	-0.24	-0.09	-0.36
0	0.27	0.11	0.38	-0.27	-0.11	-0.38
0	0.31	0.16	0.31	-0.31	-0.16	-0.31
0	0.32	0.15	0.28	-0.32	-0.15	-0.28
0	0.35	0.12	0.29	-0.35	-0.12	-0.29
0	0.36	0.16	0.3	-0.36	-0.16	-0.3
0	0.4	0.15	0.32	-0.4	-0.15	-0.32
0	0.37	0.16	0.32	-0.37	-0.16	-0.32
0	0.38	0.14	0.26	-0.38	-0.14	-0.26
0	0.41	0.13	0.26	-0.41	-0.13	-0.26
0	0.4	0.13	0.31	-0.4	-0.13	-0.31
0	0.33	0.12	0.28	-0.33	-0.12	-0.28
0	0.29	0.13	0.3	-0.29	-0.13	-0.3
0	0.22	0.07	0.29	-0.22	-0.07	-0.29
0	0.24	0.09	0.33	-0.24	-0.09	-0.33
0	0.25	0.11	0.37	-0.25	-0.11	-0.37
0	0.23	0.15	0.34	-0.23	-0.15	-0.34
0	0.24	0.15	0.38	-0.24	-0.15	-0.38
0	0.23	0.16	0.33	-0.23	-0.16	-0.33
0	0.22	0.17	0.39	-0.22	-0.17	-0.39
0	0.26	0.18	0.41	-0.26	-0.18	-0.41
0	0.26	0.15	0.39	-0.26	-0.15	-0.39
0	0.28	0.14	0.34	-0.28	-0.14	-0.34
0	0.32	0.16	0.4	-0.32	-0.16	-0.4
0	0.3	0.16	0.39	-0.3	-0.16	-0.39
0	0.29	0.16	0.38	-0.29	-0.16	-0.38
0	0.3	0.13	0.33	-0.3	-0.13	-0.33
0	0.27	0.13	0.31	-0.27	-0.13	-0.31
0	0.3	0.09	0.34	-0.3	-0.09	-0.34
0	0.31	0.09	0.36	-0.31	-0.09	-0.36
0	0.29	0.11	0.35	-0.29	-0.11	-0.35
0	0.3	0.11	0.4	-0.3	-0.11	-0.4
0	0.29	0.13	0.44	-0.29	-0.13	-0.44
0	0.27	0.15	0.41	-0.27	-0.15	-0.41
0	0.29	0.17	0.45	-0.29	-0.17	-0.45
0	0.32	0.13	0.4	-0.32	-0.13	-0.4
0	0.31	0.14	0.41	-0.31	-0.14	-0.41
0	0.3	0.17	0.45	-0.3	-0.17	-0.45

0	0.3	0.16	0.49	-0.3	-0.16	-0.49
0	0.29	0.18	0.43	-0.29	-0.18	-0.43
0	0.3	0.21	0.4	-0.3	-0.21	-0.4
0	0.32	0.16	0.43	-0.32	-0.16	-0.43
0	0.31	0.18	0.45	-0.31	-0.18	-0.45
0	0.34	0.2	0.37	-0.34	-0.2	-0.37
0	0.34	0.16	0.32	-0.34	-0.16	-0.32
0	0.3	0.17	0.3	-0.3	-0.17	-0.3
0	0.29	0.17	0.31	-0.29	-0.17	-0.31
0	0.27	0.16	0.35	-0.27	-0.16	-0.35
0	0.23	0.14	0.3	-0.23	-0.14	-0.3
0	0.23	0.14	0.34	-0.23	-0.14	-0.34
0	0.23	0.15	0.31	-0.23	-0.15	-0.31
0	0.22	0.17	0.38	-0.22	-0.17	-0.38
0	0.25	0.18	0.4	-0.25	-0.18	-0.4
0	0.23	0.17	0.4	-0.23	-0.17	-0.4
0	0.22	0.16	0.4	-0.22	-0.16	-0.4
0	0.23	0.18	0.4	-0.23	-0.18	-0.4
0	0.23	0.15	0.41	-0.23	-0.15	-0.41
0	0.27	0.18	0.42	-0.27	-0.18	-0.42
0	0.26	0.15	0.32	-0.26	-0.15	-0.32
0	0.27	0.13	0.33	-0.27	-0.13	-0.33
0	0.23	0.09	0.37	-0.23	-0.09	-0.37
0	0.23	0.03	0.37	-0.23	-0.03	-0.37
0	0.19	0.05	0.4	-0.19	-0.05	-0.4
0	0.18	0.07	0.36	-0.18	-0.07	-0.36
0	0.21	0.09	0.32	-0.21	-0.09	-0.32
0	0.28	0.09	0.3	-0.28	-0.09	-0.3
0	0.31	0.1	0.36	-0.31	-0.1	-0.36
0	0.34	0.14	0.42	-0.34	-0.14	-0.42
0	0.32	0.12	0.51	-0.32	-0.12	-0.51
0	0.31	0.13	0.5	-0.31	-0.13	-0.5
0	0.28	0.12	0.53	-0.28	-0.12	-0.53
0	0.31	0.12	0.52	-0.31	-0.12	-0.52
0	0.3	0.09	0.53	-0.3	-0.09	-0.53
0	0.28	0.11	0.6	-0.28	-0.11	-0.6
0	0.31	0.1	0.55	-0.31	-0.1	-0.55
0	0.29	0.16	0.48	-0.29	-0.16	-0.48
0	0.33	0.17	0.45	-0.33	-0.17	-0.45
0	0.33	0.14	0.4	-0.33	-0.14	-0.4
0	0.34	0.12	0.39	-0.34	-0.12	-0.39
0	0.29	0.1	0.44	-0.29	-0.1	-0.44

0	0.29	0.03	0.43	-0.29	-0.03	-0.43
0	0.28	0.06	0.42	-0.28	-0.06	-0.42
0	0.26	0.02	0.42	-0.26	-0.02	-0.42
0	0.28	0.08	0.46	-0.28	-0.08	-0.46
0	0.24	0.07	0.37	-0.24	-0.07	-0.37
0	0.22	0.08	0.38	-0.22	-0.08	-0.38
0	0.25	0.08	0.35	-0.25	-0.08	-0.35
0	0.25	0.14	0.38	-0.25	-0.14	-0.38
0	0.27	0.16	0.32	-0.27	-0.16	-0.32
0	0.31	0.16	0.32	-0.31	-0.16	-0.32
0	0.31	0.16	0.28	-0.31	-0.16	-0.28
0	0.29	0.15	0.31	-0.29	-0.15	-0.31
0	0.27	0.14	0.33	-0.27	-0.14	-0.33
0	0.27	0.17	0.35	-0.27	-0.17	-0.35
0	0.3	0.2	0.34	-0.3	-0.2	-0.34
0	0.26	0.18	0.35	-0.26	-0.18	-0.35
0	0.28	0.2	0.39	-0.28	-0.2	-0.39
0	0.29	0.21	0.37	-0.29	-0.21	-0.37
0	0.28	0.23	0.43	-0.28	-0.23	-0.43
0	0.26	0.24	0.4	-0.26	-0.24	-0.4
0	0.32	0.23	0.38	-0.32	-0.23	-0.38
0	0.29	0.21	0.36	-0.29	-0.21	-0.36
0	0.26	0.21	0.33	-0.26	-0.21	-0.33
0	0.31	0.2	0.4	-0.31	-0.2	-0.4
0	0.31	0.15	0.42	-0.31	-0.15	-0.42
0	0.3	0.17	0.35	-0.3	-0.17	-0.35
0	0.28	0.16	0.37	-0.28	-0.16	-0.37
0	0.29	0.17	0.35	-0.29	-0.17	-0.35
0	0.27	0.19	0.37	-0.27	-0.19	-0.37
0	0.28	0.22	0.37	-0.28	-0.22	-0.37
0	0.25	0.23	0.4	-0.25	-0.23	-0.4
0	0.24	0.2	0.44	-0.24	-0.2	-0.44
0	0.21	0.24	0.46	-0.21	-0.24	-0.46
0	0.23	0.21	0.41	-0.23	-0.21	-0.41
0	0.25	0.21	0.4	-0.25	-0.21	-0.4
0	0.28	0.19	0.43	-0.28	-0.19	-0.43
0	0.28	0.2	0.41	-0.28	-0.2	-0.41
0	0.29	0.18	0.27	-0.29	-0.18	-0.27
0	0.3	0.19	0.35	-0.3	-0.19	-0.35
0	0.31	0.17	0.33	-0.31	-0.17	-0.33
0	0.33	0.17	0.36	-0.33	-0.17	-0.36
0	0.32	0.18	0.37	-0.32	-0.18	-0.37

0	0.32	0.18	0.42	-0.32	-0.18	-0.42
0	0.29	0.17	0.38	-0.29	-0.17	-0.38
0	0.28	0.2	0.43	-0.28	-0.2	-0.43
0	0.33	0.19	0.45	-0.33	-0.19	-0.45
0	0.32	0.16	0.45	-0.32	-0.16	-0.45
0	0.32	0.19	0.43	-0.32	-0.19	-0.43
0	0.34	0.15	0.41	-0.34	-0.15	-0.41
0	0.3	0.16	0.4	-0.3	-0.16	-0.4
0	0.3	0.16	0.39	-0.3	-0.16	-0.39
0	0.31	0.16	0.39	-0.31	-0.16	-0.39
0	0.3	0.17	0.38	-0.3	-0.17	-0.38
0	0.26	0.2	0.42	-0.26	-0.2	-0.42
0	0.35	0.17	0.41	-0.35	-0.17	-0.41
0	0.29	0.18	0.35	-0.29	-0.18	-0.35
0	0.29	0.22	0.37	-0.29	-0.22	-0.37
0	0.26	0.22	0.36	-0.26	-0.22	-0.36
0	0.27	0.23	0.34	-0.27	-0.23	-0.34
0	0.26	0.16	0.26	-0.26	-0.16	-0.26
0	0.26	0.17	0.34	-0.26	-0.17	-0.34
0	0.24	0.2	0.3	-0.24	-0.2	-0.3
0	0.28	0.17	0.3	-0.28	-0.17	-0.3
0	0.25	0.14	0.31	-0.25	-0.14	-0.31
0	0.24	0.13	0.32	-0.24	-0.13	-0.32
0	0.22	0.1	0.34	-0.22	-0.1	-0.34
0	0.23	0.12	0.32	-0.23	-0.12	-0.32
0	0.25	0.11	0.37	-0.25	-0.11	-0.37
0	0.25	0.1	0.3	-0.25	-0.1	-0.3
0	0.27	0.11	0.25	-0.27	-0.11	-0.25
0	0.26	0.1	0.28	-0.26	-0.1	-0.28
0	0.28	0.12	0.31	-0.28	-0.12	-0.31
0	0.26	0.1	0.28	-0.26	-0.1	-0.28
0	0.23	0.11	0.24	-0.23	-0.11	-0.24
0	0.25	0.11	0.32	-0.25	-0.11	-0.32
0	0.26	0.08	0.34	-0.26	-0.08	-0.34
0	0.28	0.1	0.38	-0.28	-0.1	-0.38
0	0.29	0.1	0.35	-0.29	-0.1	-0.35
0	0.27	0.12	0.36	-0.27	-0.12	-0.36
0	0.31	0.11	0.38	-0.31	-0.11	-0.38
0	0.31	0.14	0.35	-0.31	-0.14	-0.35
0	0.31	0.13	0.36	-0.31	-0.13	-0.36
0	0.3	0.14	0.43	-0.3	-0.14	-0.43
0	0.29	0.12	0.42	-0.29	-0.12	-0.42

0	0.3	0.15	0.4	-0.3	-0.15	-0.4
0	0.27	0.14	0.42	-0.27	-0.14	-0.42
0	0.19	0.16	0.4	-0.19	-0.16	-0.4
0	0.23	0.18	0.35	-0.23	-0.18	-0.35
0	0.24	0.17	0.35	-0.24	-0.17	-0.35
0	0.29	0.13	0.35	-0.29	-0.13	-0.35
0	0.29	0.14	0.35	-0.29	-0.14	-0.35
0	0.28	0.15	0.32	-0.28	-0.15	-0.32
0	0.29	0.19	0.25	-0.29	-0.19	-0.25
0	0.27	0.22	0.28	-0.27	-0.22	-0.28
0	0.3	0.15	0.29	-0.3	-0.15	-0.29
0	0.24	0.15	0.36	-0.24	-0.15	-0.36
0	0.25	0.15	0.25	-0.25	-0.15	-0.25
0	0.25	0.15	0.29	-0.25	-0.15	-0.29
0	0.28	0.17	0.27	-0.28	-0.17	-0.27
0	0.28	0.14	0.29	-0.28	-0.14	-0.29
0	0.3	0.12	0.3	-0.3	-0.12	-0.3
0	0.28	0.11	0.34	-0.28	-0.11	-0.34
0	0.29	0.12	0.37	-0.29	-0.12	-0.37
0	0.29	0.09	0.37	-0.29	-0.09	-0.37
0	0.26	0.1	0.39	-0.26	-0.1	-0.39
0	0.28	0.12	0.32	-0.28	-0.12	-0.32
0	0.29	0.18	0.35	-0.29	-0.18	-0.35
0	0.3	0.17	0.36	-0.3	-0.17	-0.36
0	0.34	0.14	0.26	-0.34	-0.14	-0.26
0	0.34	0.12	0.38	-0.34	-0.12	-0.38
0	0.33	0.13	0.35	-0.33	-0.13	-0.35
0	0.33	0.16	0.3	-0.33	-0.16	-0.3
0	0.35	0.14	0.27	-0.35	-0.14	-0.27
0	0.36	0.15	0.33	-0.36	-0.15	-0.33
0	0.32	0.15	0.36	-0.32	-0.15	-0.36
0	0.32	0.15	0.34	-0.32	-0.15	-0.34
0	0.35	0.19	0.34	-0.35	-0.19	-0.34
0	0.33	0.16	0.37	-0.33	-0.16	-0.37
0	0.32	0.14	0.39	-0.32	-0.14	-0.39
0	0.31	0.16	0.38	-0.31	-0.16	-0.38
0	0.33	0.14	0.36	-0.33	-0.14	-0.36
0	0.32	0.13	0.34	-0.32	-0.13	-0.34
0	0.36	0.09	0.31	-0.36	-0.09	-0.31
0	0.3	0.07	0.27	-0.3	-0.07	-0.27
0	0.34	0.06	0.34	-0.34	-0.06	-0.34
0	0.32	0.1	0.37	-0.32	-0.1	-0.37

0	0.37	0.1	0.36	-0.37	-0.1	-0.36
0	0.41	0.09	0.36	-0.41	-0.09	-0.36
0	0.39	0.11	0.39	-0.39	-0.11	-0.39
0	0.36	0.12	0.4	-0.36	-0.12	-0.4
0	0.37	0.12	0.38	-0.37	-0.12	-0.38
0	0.36	0.15	0.36	-0.36	-0.15	-0.36
0	0.35	0.13	0.3	-0.35	-0.13	-0.3
0	0.31	0.14	0.28	-0.31	-0.14	-0.28
0	0.29	0.16	0.31	-0.29	-0.16	-0.31
0	0.28	0.14	0.33	-0.28	-0.14	-0.33
0	0.28	0.16	0.36	-0.28	-0.16	-0.36
0	0.26	0.18	0.37	-0.26	-0.18	-0.37
0	0.28	0.2	0.36	-0.28	-0.2	-0.36
0	0.3	0.22	0.33	-0.3	-0.22	-0.33
0	0.26	0.18	0.29	-0.26	-0.18	-0.29
0	0.31	0.19	0.3	-0.31	-0.19	-0.3
0	0.31	0.18	0.24	-0.31	-0.18	-0.24
0	0.33	0.16	0.25	-0.33	-0.16	-0.25
0	0.31	0.21	0.26	-0.31	-0.21	-0.26
0	0.32	0.18	0.29	-0.32	-0.18	-0.29
0	0.29	0.23	0.32	-0.29	-0.23	-0.32
0	0.34	0.2	0.32	-0.34	-0.2	-0.32
0	0.31	0.22	0.33	-0.31	-0.22	-0.33
0	0.32	0.21	0.28	-0.32	-0.21	-0.28
0	0.3	0.18	0.3	-0.3	-0.18	-0.3
0	0.25	0.19	0.38	-0.25	-0.19	-0.38
0	0.27	0.18	0.39	-0.27	-0.18	-0.39
0	0.24	0.19	0.37	-0.24	-0.19	-0.37
0	0.24	0.18	0.34	-0.24	-0.18	-0.34
0	0.23	0.17	0.31	-0.23	-0.17	-0.31
0	0.25	0.14	0.28	-0.25	-0.14	-0.28
0	0.26	0.17	0.29	-0.26	-0.17	-0.29
0	0.29	0.17	0.34	-0.29	-0.17	-0.34
0	0.32	0.13	0.33	-0.32	-0.13	-0.33
0	0.29	0.16	0.34	-0.29	-0.16	-0.34
0	0.29	0.2	0.39	-0.29	-0.2	-0.39
0	0.32	0.22	0.35	-0.32	-0.22	-0.35
0	0.31	0.21	0.32	-0.31	-0.21	-0.32
0	0.34	0.15	0.36	-0.34	-0.15	-0.36
0	0.32	0.18	0.34	-0.32	-0.18	-0.34
0	0.35	0.17	0.47	-0.35	-0.17	-0.47
0	0.34	0.16	0.4	-0.34	-0.16	-0.4

0	0.34	0.16	0.37	-0.34	-0.16	-0.37
0	0.34	0.17	0.32	-0.34	-0.17	-0.32
0	0.35	0.2	0.29	-0.35	-0.2	-0.29
0	0.35	0.2	0.32	-0.35	-0.2	-0.32
0	0.31	0.14	0.27	-0.31	-0.14	-0.27
0	0.36	0.12	0.29	-0.36	-0.12	-0.29
0	0.34	0.16	0.2	-0.34	-0.16	-0.2
0	0.3	0.17	0.2	-0.3	-0.17	-0.2
0	0.27	0.16	0.26	-0.27	-0.16	-0.26
0	0.31	0.19	0.34	-0.31	-0.19	-0.34
0	0.32	0.19	0.32	-0.32	-0.19	-0.32
0	0.31	0.2	0.35	-0.31	-0.2	-0.35
0	0.29	0.2	0.37	-0.29	-0.2	-0.37
0	0.27	0.23	0.36	-0.27	-0.23	-0.36
0	0.28	0.24	0.28	-0.28	-0.24	-0.28
0	0.24	0.22	0.24	-0.24	-0.22	-0.24
0	0.25	0.23	0.27	-0.25	-0.23	-0.27
0	0.24	0.18	0.3	-0.24	-0.18	-0.3
0	0.24	0.18	0.31	-0.24	-0.18	-0.31
0	0.23	0.15	0.3	-0.23	-0.15	-0.3
0	0.23	0.19	0.35	-0.23	-0.19	-0.35
0	0.26	0.14	0.4	-0.26	-0.14	-0.4
0	0.27	0.18	0.48	-0.27	-0.18	-0.48
0	0.26	0.18	0.36	-0.26	-0.18	-0.36
0	0.24	0.2	0.4	-0.24	-0.2	-0.4
0	0.26	0.18	0.31	-0.26	-0.18	-0.31
0	0.26	0.18	0.25	-0.26	-0.18	-0.25
0	0.27	0.17	0.23	-0.27	-0.17	-0.23
0	0.28	0.18	0.28	-0.28	-0.18	-0.28
0	0.27	0.13	0.28	-0.27	-0.13	-0.28
0	0.25	0.11	0.25	-0.25	-0.11	-0.25
0	0.22	0.07	0.29	-0.22	-0.07	-0.29
0	0.23	0.09	0.33	-0.23	-0.09	-0.33
0	0.23	0.07	0.33	-0.23	-0.07	-0.33
0	0.21	0.08	0.38	-0.21	-0.08	-0.38
0	0.28	0.1	0.35	-0.28	-0.1	-0.35
0	0.26	0.11	0.43	-0.26	-0.11	-0.43
0	0.27	0.16	0.37	-0.27	-0.16	-0.37
0	0.28	0.18	0.31	-0.28	-0.18	-0.31
0	0.26	0.16	0.34	-0.26	-0.16	-0.34
0	0.27	0.17	0.36	-0.27	-0.17	-0.36
0	0.34	0.18	0.34	-0.34	-0.18	-0.34

0	0.33	0.22	0.34	-0.33	-0.22	-0.34
0	0.29	0.23	0.42	-0.29	-0.23	-0.42
0	0.29	0.2	0.38	-0.29	-0.2	-0.38
0	0.31	0.16	0.35	-0.31	-0.16	-0.35
0	0.28	0.17	0.34	-0.28	-0.17	-0.34
0	0.28	0.16	0.34	-0.28	-0.16	-0.34
0	0.27	0.14	0.32	-0.27	-0.14	-0.32
0	0.26	0.12	0.3	-0.26	-0.12	-0.3
0	0.24	0.16	0.25	-0.24	-0.16	-0.25
0	0.23	0.16	0.26	-0.23	-0.16	-0.26
0	0.21	0.17	0.23	-0.21	-0.17	-0.23
0	0.18	0.21	0.28	-0.18	-0.21	-0.28
0	0.25	0.22	0.28	-0.25	-0.22	-0.28
0	0.22	0.23	0.34	-0.22	-0.23	-0.34
0	0.26	0.25	0.34	-0.26	-0.25	-0.34
0	0.28	0.2	0.35	-0.28	-0.2	-0.35
0	0.3	0.19	0.3	-0.3	-0.19	-0.3
0	0.3	0.19	0.33	-0.3	-0.19	-0.33
0	0.31	0.17	0.33	-0.31	-0.17	-0.33
0	0.3	0.1	0.36	-0.3	-0.1	-0.36
0	0.31	0.13	0.33	-0.31	-0.13	-0.33
0	0.32	0.15	0.35	-0.32	-0.15	-0.35
0	0.31	0.18	0.31	-0.31	-0.18	-0.31
0	0.28	0.21	0.38	-0.28	-0.21	-0.38
0	0.3	0.22	0.41	-0.3	-0.22	-0.41
0	0.27	0.23	0.42	-0.27	-0.23	-0.42
0	0.27	0.24	0.41	-0.27	-0.24	-0.41
0	0.21	0.25	0.36	-0.21	-0.25	-0.36
0	0.21	0.3	0.35	-0.21	-0.3	-0.35
0	0.16	0.29	0.38	-0.16	-0.29	-0.38
0	0.21	0.25	0.34	-0.21	-0.25	-0.34
0	0.23	0.24	0.33	-0.23	-0.24	-0.33
0	0.21	0.26	0.36	-0.21	-0.26	-0.36
0	0.26	0.23	0.4	-0.26	-0.23	-0.4
0	0.25	0.24	0.35	-0.25	-0.24	-0.35
0	0.24	0.22	0.37	-0.24	-0.22	-0.37
0	0.29	0.21	0.32	-0.29	-0.21	-0.32
0	0.28	0.19	0.35	-0.28	-0.19	-0.35
0	0.29	0.15	0.35	-0.29	-0.15	-0.35
0	0.3	0.16	0.31	-0.3	-0.16	-0.31
0	0.33	0.18	0.3	-0.33	-0.18	-0.3
0	0.33	0.19	0.3	-0.33	-0.19	-0.3

0	0.34	0.21	0.32	-0.34	-0.21	-0.32
0	0.32	0.19	0.37	-0.32	-0.19	-0.37
0	0.27	0.19	0.37	-0.27	-0.19	-0.37
0	0.32	0.2	0.34	-0.32	-0.2	-0.34
0	0.31	0.21	0.4	-0.31	-0.21	-0.4
0	0.28	0.22	0.37	-0.28	-0.22	-0.37
0	0.28	0.17	0.37	-0.28	-0.17	-0.37
0	0.27	0.18	0.36	-0.27	-0.18	-0.36
0	0.31	0.2	0.38	-0.31	-0.2	-0.38
0	0.3	0.22	0.35	-0.3	-0.22	-0.35
0	0.29	0.23	0.29	-0.29	-0.23	-0.29
0	0.26	0.24	0.33	-0.26	-0.24	-0.33
0	0.28	0.2	0.28	-0.28	-0.2	-0.28
0	0.29	0.2	0.34	-0.29	-0.2	-0.34
0	0.28	0.16	0.39	-0.28	-0.16	-0.39
0	0.26	0.15	0.36	-0.26	-0.15	-0.36
0	0.27	0.15	0.35	-0.27	-0.15	-0.35
0	0.16	-0.33	0.29	-0.16	0.33	-0.29
0	0.26	-0.06	0.21	-0.26	0.06	-0.21
0	0.26	0.08	0.32	-0.26	-0.08	-0.32
0	0.22	0.07	0.34	-0.22	-0.07	-0.34
0	0.24	0.14	0.39	-0.24	-0.14	-0.39
0	0.39	0.19	0.31	-0.39	-0.19	-0.31
0	0.29	0.25	0.31	-0.29	-0.25	-0.31
0	0.26	0.25	0.25	-0.26	-0.25	-0.25
0	0.28	0.22	0.29	-0.28	-0.22	-0.29
0	0.37	0.24	0.32	-0.37	-0.24	-0.32
0	0.3	0.12	0.33	-0.3	-0.12	-0.33
0	0.33	0.13	0.34	-0.33	-0.13	-0.34
0	0.31	0.29	0.46	-0.31	-0.29	-0.46
0	0.5	0.18	0.54	-0.5	-0.18	-0.54
0	0.7	0.17	0.52	-0.7	-0.17	-0.52
0	1.02	0.17	0.28	-1.02	-0.17	-0.28
0	0.82	-0.08	0.3	-0.82	0.08	-0.3
0	0.91	0.15	0.51	-0.91	-0.15	-0.51
0	1.15	0.21	0.56	-1.15	-0.21	-0.56
0	1.46	0.76	0.49	-1.46	-0.76	-0.49
0	0.14	0.81	-0.08	-0.14	-0.81	0.08
0	-1.61	-0.18	-0.67	1.61	0.18	0.67
0	-1.97	-0.98	-0.86	1.97	0.98	0.86
0	0.41	-0.88	-0.41	-0.41	0.88	0.41
0	2.51	-0.46	0.18	-2.51	0.46	-0.18

0	2.16	-0.39	0.1	-2.16	0.39	-0.1
0	0.38	-0.49	-0.09	-0.38	0.49	0.09
0	-0.45	-0.09	-0.02	0.45	0.09	0.02
0	0.79	1.57	0.35	-0.79	-1.57	-0.35
0	1.37	3.49	0.61	-1.37	-3.49	-0.61
0	-1.44	2.89	0	1.44	-2.89	0
0	-3.35	0.38	-0.28	3.35	-0.38	0.28
0	-1.52	-1.51	-0.49	1.52	1.51	0.49
0	1.15	-1.63	0.28	-1.15	1.63	-0.28
0	1.13	-1.35	0.28	-1.13	1.35	-0.28
0	-1.72	-0.86	-0.1	1.72	0.86	0.1
0	-2.69	-0.37	-0.51	2.69	0.37	0.51
0	-0.16	-0.32	0.15	0.16	0.32	-0.15
0	2.03	-0.05	1.33	-2.03	0.05	-1.33
0	1.01	-0.9	0.95	-1.01	0.9	-0.95
0	-1.33	-2.3	-0.42	1.33	2.3	0.42
0	-0.73	-1.79	-0.43	0.73	1.79	0.43
0	0.91	-0.63	0.44	-0.91	0.63	-0.44
0	0.97	-0.47	1.27	-0.97	0.47	-1.27
0	0.55	-0.38	1.39	-0.55	0.38	-1.39
0	1.2	1.54	1.5	-1.2	-1.54	-1.5
0	0.69	2.18	1.41	-0.69	-2.18	-1.41
0	-1.19	-0.55	0.79	1.19	0.55	-0.79
0	-0.13	-2.09	0.02	0.13	2.09	-0.02
0	2.43	0.35	0.51	-2.43	-0.35	-0.51
0	1.93	2.35	1.28	-1.93	-2.35	-1.28
0	-1.1	1.16	0.59	1.1	-1.16	-0.59
0	-1.8	-0.13	-0.67	1.8	0.13	0.67
0	1.71	2.23	0.72	-1.71	-2.23	-0.72
0	3.86	4.84	3.14	-3.86	-4.84	-3.14
0	0.62	2.71	1.92	-0.62	-2.71	-1.92
0	-2.46	-0.97	-0.96	2.46	0.97	0.96
0	-1.33	-1.09	-1.33	1.33	1.09	1.33
0	1.68	2.17	1.45	-1.68	-2.17	-1.45
0	2.75	3.93	3.3	-2.75	-3.93	-3.3
0	0.96	2.06	1.74	-0.96	-2.06	-1.74
0	-2.26	-1.73	-1.15	2.26	1.73	1.15
0	-1.96	-3.09	-1	1.96	3.09	1
0	1.97	-0.9	1.13	-1.97	0.9	-1.13
0	2.61	-0.15	1.43	-2.61	0.15	-1.43
0	-0.32	-1.97	-0.33	0.32	1.97	0.33
0	-0.54	-2.19	-0.67	0.54	2.19	0.67

0	2.25	0.32	1.3	-2.25	-0.32	-1.3
0	2.67	1.43	1.81	-2.67	-1.43	-1.81
0	-0.74	-0.05	-0.44	0.74	0.05	0.44
0	-2.82	0.48	-1.34	2.82	-0.48	1.34
0	-0.42	3.59	1.25	0.42	-3.59	-1.25
0	1.17	2.69	2.47	-1.17	-2.69	-2.47
0	-0.37	-2.62	-0.2	0.37	2.62	0.2
0	-0.94	-5.24	-1.93	0.94	5.24	1.93
0	1.76	-1.43	0.82	-1.76	1.43	-0.82
0	3.34	2.64	3.13	-3.34	-2.64	-3.13
0	0.71	2.17	1.36	-0.71	-2.17	-1.36
0	-2.86	-0.18	-1.18	2.86	0.18	1.18
0	-1.82	0.62	0.06	1.82	-0.62	-0.06
0	2.42	3.16	3.26	-2.42	-3.16	-3.26
0	3.76	2.6	3.96	-3.76	-2.6	-3.96
0	0.8	-1.13	0.78	-0.8	1.13	-0.78
0	-1.66	-3.14	-0.85	1.66	3.14	0.85
0	0.43	-0.98	0.22	-0.43	0.98	-0.22
0	1.36	1.79	1.57	-1.36	-1.79	-1.57
0	-1.57	1.02	0.33	1.57	-1.02	-0.33
0	-3.2	-1.17	-1.37	3.2	1.17	1.37
0	-0.26	0.04	0.07	0.26	-0.04	-0.07
0	1.94	1.89	2.05	-1.94	-1.89	-2.05
0	0.67	0.12	1.13	-0.67	-0.12	-1.13
0	0.17	-1.87	-0.99	-0.17	1.87	0.99
0	1.71	0.38	0.16	-1.71	-0.38	-0.16
0	1.11	2.38	1.66	-1.11	-2.38	-1.66
0	-1.58	0.22	-0.52	1.58	-0.22	0.52
0	-1.43	-0.75	-1.55	1.43	0.75	1.55
0	1.1	1.51	0.57	-1.1	-1.51	-0.57
0	1.33	2.68	2.21	-1.33	-2.68	-2.21
0	-0.23	0.65	0.38	0.23	-0.65	-0.38
0	0.76	0.41	-0.78	-0.76	-0.41	0.78
0	2.49	2.99	2.13	-2.49	-2.99	-2.13
0	-0.7	-0.64	2.06	0.7	0.64	-2.06
0	-1.83	-6.64	-0.08	1.83	6.64	0.08
0	3.53	-5.84	1.36	-3.53	5.84	-1.36
0	1.53	-9.14	-0.46	-1.53	9.14	0.46
0	1.34	-7.48	-1.12	-1.34	7.48	1.12
0	0.94	-6.18	-0.85	-0.94	6.18	0.85
0	0.88	-4.9	-0.66	-0.88	4.9	0.66
0	0.9	-3.89	-0.48	-0.9	3.89	0.48

0	0.96	-3.02	-0.33	-0.96	3.02	0.33
0	0.92	-2.32	-0.2	-0.92	2.32	0.2
0	0.88	-1.76	-0.08	-0.88	1.76	0.08
0	0.83	-1.31	-0.02	-0.83	1.31	0.02
0	0.85	-0.92	0	-0.85	0.92	0
0	0.82	-0.59	0.09	-0.82	0.59	-0.09
0	0.61	-0.45	0.09	-0.61	0.45	-0.09
0	0.57	-0.35	0.22	-0.57	0.35	-0.22
0	0.54	-0.27	0.28	-0.54	0.27	-0.28
0	0.38	-0.2	0.26	-0.38	0.2	-0.26
0	0.25	-0.18	0.28	-0.25	0.18	-0.28
0	0.11	-0.15	0.32	-0.11	0.15	-0.32
0	0.04	-0.18	0.37	-0.04	0.18	-0.37
0	0.07	-0.09	0.25	-0.07	0.09	-0.25
0	0.08	-0.04	0.31	-0.08	0.04	-0.31
0	0.34	0.17	0.32	-0.34	-0.17	-0.32
0	0.35	0.2	0.29	-0.35	-0.2	-0.29
0	0.35	0.2	0.32	-0.35	-0.2	-0.32
0	0.31	0.14	0.27	-0.31	-0.14	-0.27
0	0.36	0.12	0.29	-0.36	-0.12	-0.29
0	0.34	0.16	0.2	-0.34	-0.16	-0.2
0	0.3	0.17	0.2	-0.3	-0.17	-0.2
0	0.27	0.16	0.26	-0.27	-0.16	-0.26
0	0.31	0.19	0.34	-0.31	-0.19	-0.34
0	0.32	0.19	0.32	-0.32	-0.19	-0.32
0	0.31	0.2	0.35	-0.31	-0.2	-0.35
0	0.29	0.2	0.37	-0.29	-0.2	-0.37
0	0.27	0.23	0.36	-0.27	-0.23	-0.36
0	0.28	0.24	0.28	-0.28	-0.24	-0.28
0	0.24	0.22	0.24	-0.24	-0.22	-0.24
0	0.25	0.23	0.27	-0.25	-0.23	-0.27
0	0.24	0.18	0.3	-0.24	-0.18	-0.3
0	0.24	0.18	0.31	-0.24	-0.18	-0.31
0	0.23	0.15	0.3	-0.23	-0.15	-0.3
0	0.23	0.19	0.35	-0.23	-0.19	-0.35
0	0.26	0.14	0.4	-0.26	-0.14	-0.4
0	0.27	0.18	0.48	-0.27	-0.18	-0.48
0	0.26	0.18	0.36	-0.26	-0.18	-0.36
0	0.24	0.2	0.4	-0.24	-0.2	-0.4
0	0.26	0.18	0.31	-0.26	-0.18	-0.31
0	0.26	0.18	0.25	-0.26	-0.18	-0.25
0	0.27	0.17	0.23	-0.27	-0.17	-0.23

0	0.28	0.18	0.28	-0.28	-0.18	-0.28
0	0.27	0.13	0.28	-0.27	-0.13	-0.28
0	0.25	0.11	0.25	-0.25	-0.11	-0.25
0	0.22	0.07	0.29	-0.22	-0.07	-0.29
0	0.23	0.09	0.33	-0.23	-0.09	-0.33
0	0.23	0.07	0.33	-0.23	-0.07	-0.33
0	0.21	0.08	0.38	-0.21	-0.08	-0.38
0	0.28	0.1	0.35	-0.28	-0.1	-0.35
0	0.26	0.11	0.43	-0.26	-0.11	-0.43

LAMPIRAN 3

LISTING PROGRAM ARDUINO

```
#include <Wire.h>

float pid_p_gain = 2.19924;
float pid_i_gain= 0.52267;
float pid_d_gain = 12.54983;
int pid_max_roll = 400;

int receiver_input_channel_1, receiver_input_channel_2, receiver_input_channel_3,
receiver_input_channel_4;
int counter_channel_1, counter_channel_2, counter_channel_3, counter_channel_4,
loop_counter;
int esc_1, esc_2, esc_3, esc_4;
int throttle, battery_voltage;
unsigned long timer_channel_1, timer_channel_2, timer_channel_3, timer_channel_4,
esc_timer, esc_loop_timer;
unsigned long timer_1, timer_2, timer_3, timer_4, current_time;
int cal_int, start;
unsigned long loop_timer;
double gyro_pitch, gyro_roll, gyro_yaw;
double gyro_roll_cal, gyro_pitch_cal, gyro_yaw_cal;
byte highByte, lowByte;

void setup(){

  Wire.begin();
```

```
DDRD |= B11110000;
DDRB |= B00110000;

digitalWrite(12,HIGH);
delay(3000);

Wire.beginTransmission(105);
Wire.write(0x20);
Wire.write(0x0F);
Wire.endTransmission();

Wire.beginTransmission(105);
Wire.write(0x23);
Wire.write(0x90);
Wire.endTransmission();

delay(250);

for (cal_int = 0; cal_int < 2000 ; cal_int ++){
  if(cal_int % 15 == 0)digitalWrite(12, !digitalRead(12));
  gyro_signalen();
  gyro_roll_cal += gyro_roll;
  gyro_pitch_cal += gyro_pitch;
  gyro_yaw_cal += gyro_yaw;

  PORTD |= B11110000;
  delayMicroseconds(1000);
  PORTD &= B00001111;
  delay(3);
}
```

```
gyro_roll_cal /= 2000;  
gyro_pitch_cal /= 2000;  
gyro_yaw_cal /= 2000;
```

```
PCICR |= (1 << PCIE0);  
PCMSK0 |= (1 << PCINT0);  
PCMSK0 |= (1 << PCINT1);  
PCMSK0 |= (1 << PCINT2);  
PCMSK0 |= (1 << PCINT3);
```

```
while(receiver_input_channel_3 < 990 || receiver_input_channel_3 > 1020 ||  
receiver_input_channel_4 < 1400){  
    start ++;  
    PORTD |= B11110000;  
    delayMicroseconds(1000);  
    PORTD &= B00001111;  
    delay(3);  
    if(start == 125){  
        digitalWrite(12, !digitalRead(12));  
        start = 0;  
    }  
}  
start = 0;
```

```
battery_voltage = (analogRead(0) + 65) * 1.2317;
```

```
digitalWrite(12,LOW);  
}
```

```
void loop(){
```

```

gyro_signalen();
gyro_roll_input = (gyro_roll_input * 0.8) + ((gyro_roll / 57.14286) * 0.2);      //Gyro
pid input is deg/sec.
gyro_pitch_input = (gyro_pitch_input * 0.8) + ((gyro_pitch / 57.14286) * 0.2);
//Gyro pid input is deg/sec.
gyro_yaw_input = (gyro_yaw_input * 0.8) + ((gyro_yaw / 57.14286) * 0.2);
//Gyro pid input is deg/sec.

if(receiver_input_channel_3 < 1050 && receiver_input_channel_4 < 1050)start = 1;

if(start == 1 && receiver_input_channel_3 < 1050 && receiver_input_channel_4 >
1450){
    start = 2;

    pid_i_mem_roll = 0;
    pid_last_roll_d_error = 0;
    pid_i_mem_pitch = 0;
    pid_last_pitch_d_error = 0;
    pid_i_mem_yaw = 0;
    pid_last_yaw_d_error = 0;
}

if(start == 2 && receiver_input_channel_3 < 1050 && receiver_input_channel_4 >
1950)start = 0;
    pid_roll_setpoint = 0;
if(receiver_input_channel_1 > 1508)pid_roll_setpoint = (receiver_input_channel_1 -
1508)/3.0;
else if(receiver_input_channel_1 < 1492)pid_roll_setpoint = (receiver_input_channel_1 -
1492)/3.0;

```



```

    pid_pitch_setpoint = 0;
    if(receiver_input_channel_2 > 1508)pid_pitch_setpoint = (receiver_input_channel_2 -
1508)/3.0;
    else if(receiver_input_channel_2 < 1492)pid_pitch_setpoint = (receiver_input_channel_2
- 1492)/3.0;

    pid_yaw_setpoint = 0;

    if(receiver_input_channel_3 > 1050){
        if(receiver_input_channel_4 > 1508)pid_yaw_setpoint = (receiver_input_channel_4 -
1508)/3.0;
        else if(receiver_input_channel_4 < 1492)pid_yaw_setpoint = (receiver_input_channel_4
- 1492)/3.0;
    }

    calculate_pid();

    battery_voltage = battery_voltage * 0.92 + (analogRead(0) + 65) * 0.09853;

    if(battery_voltage < 1050 && battery_voltage > 600)digitalWrite(12, HIGH);

    throttle = receiver_input_channel_3;

    if (start == 2){
        if (throttle > 1800) throttle = 1800;
        esc_1 = throttle - pid_output_pitch + pid_output_roll - pid_output_yaw;
        esc_2 = throttle + pid_output_pitch + pid_output_roll + pid_output_yaw;
        esc_3 = throttle + pid_output_pitch - pid_output_roll - pid_output_yaw;
        esc_4 = throttle - pid_output_pitch - pid_output_roll + pid_output_yaw;

        if (battery_voltage < 1240 && battery_voltage > 800){
            esc_1 += esc_1 * ((1240 - battery_voltage)/(float)3500);

```

```
    esc_2 += esc_2 * ((1240 - battery_voltage)/(float)3500);
    esc_3 += esc_3 * ((1240 - battery_voltage)/(float)3500);
    esc_4 += esc_4 * ((1240 - battery_voltage)/(float)3500);
}

if (esc_1 < 1200) esc_1 = 1200;
if (esc_2 < 1200) esc_2 = 1200;
if (esc_3 < 1200) esc_3 = 1200;
if (esc_4 < 1200) esc_4 = 1200;

if(esc_1 > 2000)esc_1 = 2000;
if(esc_2 > 2000)esc_2 = 2000;
if(esc_3 > 2000)esc_3 = 2000;
if(esc_4 > 2000)esc_4 = 2000;
}

else{
    esc_1 = 1000;
    esc_2 = 1000;
    esc_3 = 1000;
    esc_4 = 1000;
}

while(micros() - loop_timer < 4000);
loop_timer = micros();

PORTD |= B11110000;
timer_channel_1 = esc_1 + loop_timer;
timer_channel_2 = esc_2 + loop_timer;
timer_channel_3 = esc_3 + loop_timer;
timer_channel_4 = esc_4 + loop_timer;
```

```

while(PORTD >= 16){
    esc_loop_timer = micros();
    if(timer_channel_1 <= esc_loop_timer)PORTD &= B11101111;
    if(timer_channel_2 <= esc_loop_timer)PORTD &= B11011111;
    if(timer_channel_3 <= esc_loop_timer)PORTD &= B10111111;
    if(timer_channel_4 <= esc_loop_timer)PORTD &= B01111111;
}
}

```

```

ISR(PCINT0_vect){
    current_time = micros();
    //Channel 1=====
    if(PINB & B00000001){
        if(last_channel_1 == 0){
            last_channel_1 = 1;
            timer_1 = current_time;
        }
    }
    else if(last_channel_1 == 1){
        last_channel_1 = 0;
        receiver_input_channel_1 = current_time - timer_1;
    }
    //Channel 2=====
    if(PINB & B00000010 ){
        if(last_channel_2 == 0){
            last_channel_2 = 1;
            timer_2 = current_time;
        }
    }
    else if(last_channel_2 == 1){

```

```

    last_channel_2 = 0;
    receiver_input_channel_2 = current_time - timer_2;
}
//Channel 3=====
if(PINB & B00000100 ){
    if(last_channel_3 == 0){
        last_channel_3 = 1;
        timer_3 = current_time;
    }
}
else if(last_channel_3 == 1){
    last_channel_3 = 0;
    receiver_input_channel_3 = current_time - timer_3;

}

//Channel 4=====
if(PINB & B00001000 ){
    if(last_channel_4 == 0){
        last_channel_4 = 1;
        timer_4 = current_time;
    }
}
else if(last_channel_4 == 1){
    last_channel_4 = 0;
    receiver_input_channel_4 = current_time - timer_4;
}
}

void gyro_signalen(){
    Wire.beginTransmission(105);
    Wire.write(168);

```

```

Wire.endTransmission();
Wire.requestFrom(105, 6);
while(Wire.available() < 6);
lowByte = Wire.read();
highByte = Wire.read();
gyro_roll = ((highByte<<8)|lowByte);
if(cal_int == 2000)gyro_roll -= gyro_roll_cal;
lowByte = Wire.read();
highByte = Wire.read();
gyro_pitch = ((highByte<<8)|lowByte);
gyro_pitch *= -1;
if(cal_int == 2000)gyro_pitch -= gyro_pitch_cal;
lowByte = Wire.read();
highByte = Wire.read();
gyro_yaw = ((highByte<<8)|lowByte);
gyro_yaw *= -1;
if(cal_int == 2000)gyro_yaw -= gyro_yaw_cal;
}

```

```

void calculate_pid(){
//Roll calculations
pid_error_temp = gyro_roll_input - pid_setpoint;
pid_i_mem += pid_i_gain * pid_error_temp;
if(pid_i_mem > pid_max)pid_i_mem = pid_max;
else if(pid_i_mem < pid_max * -1)pid_i_mem = pid_max * -1;

pid_output_roll = pid_p_gain * pid_error_temp + pid_i_mem + pid_d_gain *
(pid_error_temp - pid_last_d_error);
if(pid_output > pid_max)pid_output = pid_max;
else if(pid_output_roll < pid_max_roll * -1)pid_output_roll = pid_max_roll * -1;

```

```
pid_last_roll_d_error = pid_error_temp;
```

```
pid_error_temp = gyro_pitch_input - pid_setpoint;
```

```
pid_i_mem += pid_i_gain* pid_error_temp;
```

```
if(pid_i_mem > pid_max)pid_i_mem = pid_max;
```

```
else if(pid_i_mem_pitch < pid_max_pitch * -1)pid_i_mem_pitch = pid_max_pitch * -1;
```

```
pid_output_pitch = pid_p_gain * pid_error_temp + pid_i_mem + pid_d_gain *  
(pid_error_temp - pid_last_d_error);
```

```
if(pid_output > pid_max)pid_output = pid_max;
```

```
else if(pid_output < pid_max * -1)pid_output = pid_max * -1;
```

```
pid_last_d_error = pid_error_temp;
```

```
pid_error_temp = gyro_yaw_input - pid_setpoint;
```

```
pid_i_mem += pid_i_gain * pid_error_temp;
```

```
if(pid_i_mem > pid_max)pid_i_mem = pid_max;
```

```
else if(pid_i_mem < pid_max * -1)pid_i_mem = pid_max * -1;
```

```
pid_output_yaw = pid_p_gain * pid_error_temp + pid_i_mem + pid_d_gain*  
(pid_error_temp - pid_last_d_error);
```

```
if(pid_output > pid_max)pid_output = pid_max;
```

```
else if(pid_output < pid_max * -1)pid_output = pid_max * -1;
```

```
pid_last_yaw_d_error = pid_error_temp;
```

```
}
```

LAMPIRAN 4

LISTING PROGRAM MATLAB

```
x = linspace(0,67.9,1394);

figure
plot(x,roll,'g',x,Set,'r')
ylim([-15 15])
xlabel('Time(second)')
ylabel('Sudut(derajat)')
title('keluaran sudut roll')
legend('roll','Setpoint')
hold on

figure
plot(x,pitch,'b',x,Set,'r')
ylim([-15 15])
xlabel('Time(second)')
ylabel('Sudut(derajat)')
title('keluaran sudut pitch')
legend('pitch','Setpoint')
hold on

figure
plot(x,yaw,'y',x,Set,'r')
ylim([-15 15])
xlabel('Time(second)')
ylabel('Sudut(derajat)')
title('Keluaran sudut yaw')
legend('yaw','Setpoint')
hold on

figure
plot(x,pitch,'b',x,roll,'g',x,yaw,'y',x,Set,'r')
ylim([-15 15])
xlabel('Time(second)')
ylabel('Sudut(derajat)')
title('Keluaran Sudut Keseluruhan')
legend('pitch','roll','yaw','Setpoint')
hold on
```

LAMPIRAN 5

DATASHEET

ARDUINO

Arduino Uno



Arduino Uno R3 Front



Arduino Uno R3 Back



Arduino Uno R2 Front



Arduino Uno SMD



Arduino Uno Front



Arduino Uno Back

Overview

The Arduino Uno is a microcontroller board based on the ATmega328 ([datasheet](#)). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into [DFU mode](#).

Revision 3 of the board has the following new features:

- 1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the

Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

Schematic & Reference Design

EAGLE files: [arduino-uno-Rev3-reference-design.zip](#) (NOTE: works with Eagle 6.0 and newer)

Schematic: [arduino-uno-Rev3-schematic.pdf](#)

Note: The Arduino reference design can use an Atmega8, 168, or 328. Current models use an ATmega328, but an Atmega8 is shown in the schematic for reference. The pin configuration is identical on all three processors.

Power

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The power pins are as follows:

- **VIN.** The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V.** This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.
- **3V3.** A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND.** Ground pins.

Memory

The ATmega328 has 32 KB (with 0.5 KB used for the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the [EEPROM library](#)).

Bluetooth



HC-05

-Bluetooth to Serial Port Module

Overview



HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup.


Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycle.

Specifications

Hardware features

- Typical -80dBm sensitivity
- Up to +4dBm RF transmit power
- Low Power 1.8V Operation ,1.8 to 3.6V I/O
- PIO control
- UART interface with programmable baud rate
- With integrated antenna
- With edge connector

MPU6050

	MPU-6000/MPU-6050 Product Specification	Document Number: PS-MPU-6000A-00 Revision: 1.0 Release Date: 11/24/2010
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6 Electrical Characteristics

6.1 Gyroscope Specifications

VDD = 2.5V±5%, 3.0V±5%, or 3.3V±5%, VLOGIC (MPU-6050 only) = 1.8V±5% or VDD, T_A = 25°C


PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
GYROSCOPE SENSITIVITY						
Full-Scale Range	FS_SEL=3 FS_SEL=2 FS_SEL=1 FS_SEL=0		±2000 ±1000 ±500 ±250		% % % %	
Gyroscope ADC Word Length			16		bits	
Sensitivity Scale Factor	FS_SEL=0 FS_SEL=1 FS_SEL=2 FS_SEL=3		131 65.5 32.8 16.4		LSB/(% LSB/(% LSB/(% LSB/(%	
Sensitivity Scale Factor Tolerance	25°C	-3		+3	%	
Sensitivity Scale Factor Variation Over Temperature			±2		%	
Nonlinearity	Best fit straight line; 25°C		0.2		%	
Cross-Axis Sensitivity			±2		%	
GYROSCOPE ZERO-RATE OUTPUT (ZRO)						
Initial ZRO Tolerance	25°C		±20		%	
ZRO Variation Over Temperature	-40°C to +85°C		±20		%	
Power-Supply Sensitivity (1-10Hz)	Sine wave, 100mVpp, VDD=2.5V		0.2		%	
Power-Supply Sensitivity (10 - 250Hz)	Sine wave, 100mVpp, VDD=2.5V		0.2		%	
Power-Supply Sensitivity (250Hz - 100kHz)	Sine wave, 100mVpp, VDD=2.5V		4		%	
Linear Acceleration Sensitivity	5%/g		0.1		%/g	
GYROSCOPE NOISE PERFORMANCE	FS_SEL=0 DLPFCFG=2 (100Hz)		0.05		%-rms	
Total RMS Noise	Bandwidth 1Hz to 10Hz		0.033		%-rms	
Low-frequency RMS noise	At 10Hz		0.005		%/√Hz	
Rate Noise Spectral Density						
GYROSCOPE MECHANICAL FREQUENCIES						
X-Axis		30	33	36	kHz	
Y-Axis		27	30	33	kHz	
Z-Axis		24	27	30	kHz	
SELF TEST RESPONSE	X, Y, and Z axes		50		%	
OUTPUT DATA RATE	Programmable	4		8,000	Hz	
GYROSCOPE START-UP TIME	DLPFCFG=0		30		ms	
ZRO Settling	to ±1% of Final					

	MPU-6000/MPU-6050 Product Specification	Document Number: PS-MPU-6000A-00 Revision: 1.0 Release Date: 11/24/2010
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6.2 Accelerometer Specifications

VDD = 2.5V±5%, 3.0V±5%, or 3.3V±5%, VLOGIC (MPU-6050 only) = 1.8V±5% or VDD, T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS	NOTES
ACCELEROMETER SENSITIVITY Full-Scale Range	±2g mode		±2		g	
	±4g mode		±4		g	
	±8g mode		±8		g	
	±16g mode		±16		g	
ADC Word Length	Output in two's complement format		16		bits	
Sensitivity Scale Factor	±2g mode		0.06		mg/LSB	
	±4g mode		0.12		mg/LSB	
	±8g mode		0.24		mg/LSB	
	±16g mode		0.49		mg/LSB	
Initial Calibration Tolerance			±3		%	
Sensitivity Change vs. Temperature	(±2g)		±0.02		%/°C	
Nonlinearity	Best Fit Straight Line		0.5		%	
Cross-Axis Sensitivity			±2		%	
ZERO-G OUTPUT						
Initial Calibration Tolerance			±50		mg	
Zero-G Level Change vs. Temperature			±1		mg/°C	
SELF TEST RESPONSE						
	X, Y, and Z axes		0.5		g	
NOISE PERFORMANCE						
Power Spectral Density	@10Hz		350		µg/√Hz	
LOW PASS FILTER RESPONSE						
	Programmable Range	5		250	Hz	
OUTPUT DATA RATE						
	Programmable Range	4		1,000	Hz	

	MPU-6000/MPU-6050 Product Specification	Document Number: PS-MPU-6000A-00 Revision: 1.0 Release Date: 11/24/2010
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6.3 Electrical and Other Common Specifications

VDD = 2.5V±5%, 3.0V±5%, or 3.3V±5%, VLOGIC (MPU-6050 only) = 1.8V±5% or VDD, T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	Units	Notes
VDD POWER SUPPLY						
Operating Voltage			2.5±5% 3.0±5% 3.3±5%		V	
Normal Operating Current	Gyroscope + Accelerometer + DMP Gyroscope + DMP (Accelerometer disabled)		5.5		mA	
			5.0		mA	
		Accelerometer only (DMP & Gyroscope disabled)	500		µA	
Accelerometer Low Power Mode Current	10Hz update rate		40		µA	
Full-Chip Idle Mode Supply Current			5		µA	
Power Supply Ramp Rate	Monotonic ramp. Ramp rate is 10% to 90% of the final value			100	ms	
VLOGIC REFERENCE VOLTAGE						
Voltage Range	MPU-6050 only VLOGIC must be ≤VDD at all times	1.71		VDD	V	
Power Supply Ramp Rate	Monotonic ramp. Ramp rate is 10% to 90% of the final value			3	ms	
Normal Operating Current			100		µA	
START-UP TIME FOR REGISTER READ/WRITE						
			20	100	ms	
TEMPERATURE RANGE						
Specified Temperature Range	Performance parameters are not applicable beyond Specified Temperature Range	-40		+85	°C	
SERIAL INTERFACE						
SPI Operating Frequency, All Registers Read/Write	MPU-6000 only, Low Speed Characterization		100 ±10%		kHz	
	MPU-6000 only, High Speed Characterization		1 ±10%		MHz	
SPI Operating Frequency, Sensor and Interrupt Registers Read Only	MPU-6000 only		20 ±10%		MHz	
I ² C Operating Frequency	All registers, Fast-mode			400	kHz	
	All registers, Standard-mode			100	kHz	

MOTOR BLDC OUTRUNNER T-REX 1000KV**Specifications:**

Type: A2212/13
No. Of cells:2-3 Li-Poly
RPM/V:1000 RMP/V
Max. efficiency:80%
Max. efficiency current:4-10A (>75%)
No load current / 10 V:0,5 A
Current capacity:12A/60 s
Internal Resistance: 90 mΩ
Dimensions:27.5x30 mm
Shaft diameter: 3.17 mm
Weight:47 g