

4 Bit Binary Full Adder

Robotics 131 – Spring 2022 Online

Casey L. Raiford 27 March 2022

1. Truth Table lines 1-34

1	$2^7=128$	$2^6=64$	$2^5=32$	$2^4=16$	$2^3=8$	$2^2=4$	$2^1=2$	$2^0=1$					
2	A3	B3	A2	B2	A1	B1	A0	B0	S0	S1	S2	S3	Cout
3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	1	1	0	0	0	0
5	0	0	0	0	0	0	1	0	1	0	0	0	0
6	0	0	0	0	0	0	1	1	0	1	0	0	0
7	0	0	0	0	0	1	0	0	0	1	0	0	0
8	0	0	0	0	0	1	0	1	1	1	1	0	0
9	0	0	0	0	0	1	1	0	1	1	0	0	0
10	0	0	0	0	0	1	1	1	0	0	1	0	0
11	0	0	0	0	1	0	0	0	0	1	0	0	0
12	0	0	0	0	1	0	0	1	1	1	0	0	0
13	0	0	0	0	1	0	1	0	1	1	0	0	0
14	0	0	0	0	1	0	1	1	0	0	1	0	0
15	0	0	0	0	1	1	0	0	0	0	1	0	0
16	0	0	0	0	1	1	0	1	1	0	1	1	0
17	0	0	0	0	1	1	1	0	1	0	1	1	0
18	0	0	0	0	1	1	0	1	1	0	1	1	0
19	0	0	0	1	0	0	0	0	0	0	1	0	0
20	0	0	0	1	0	0	0	1	1	0	1	0	0
21	0	0	0	1	0	0	1	0	1	0	1	0	0
22	0	0	0	1	0	0	1	1	0	1	1	0	0
23	0	0	0	1	0	1	0	0	0	1	1	0	0
24	0	0	0	1	0	1	0	1	1	1	1	0	0
25	0	0	0	1	0	1	1	0	1	1	1	0	0
26	0	0	0	1	0	1	1	1	0	0	0	1	0
27	0	0	0	1	1	0	0	0	0	1	1	0	0
28	0	0	0	1	1	0	0	1	1	1	1	0	0
29	0	0	0	1	1	0	1	0	1	1	1	0	0
30	0	0	0	1	1	0	1	1	0	0	0	1	0
31	0	0	0	1	1	1	0	0	0	0	0	1	0
32	0	0	0	1	1	1	0	1	1	0	0	1	0
33	0	0	0	1	1	1	1	0	1	0	0	1	0
34	0	0	0	1	1	1	0	1	1	0	0	1	0

1. Truth Table lines 35-68

	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	$2^7=128$	$2^6=64$	$2^5=32$	$2^4=16$	$2^3=8$	$2^2=4$	$2^1=2$	$2^0=1$					
2	A3	B3	A2	B2	A1	B1	A0	B0	S0	S1	S2	S3	Cout
35	0	0	1	0	0	0	0	0	0	0	1	0	0
36	0	0	1	0	0	0	0	1	1	0	1	0	0
37	0	0	1	0	0	0	1	0	1	0	1	0	0
38	0	0	1	0	0	0	1	1	0	1	1	0	0
39	0	0	1	0	0	1	0	0	0	1	1	0	0
40	0	0	1	0	0	1	0	1	1	1	1	0	0
41	0	0	1	0	0	1	1	0	1	1	1	0	0
42	0	0	1	0	0	1	1	1	0	0	0	1	0
43	0	0	1	0	1	0	0	0	0	1	1	0	0
44	0	0	1	0	1	0	0	1	1	1	1	0	0
45	0	0	1	0	1	0	1	0	1	1	1	0	0
46	0	0	1	0	1	0	1	1	0	0	0	1	0
47	0	0	1	0	1	1	0	0	0	0	0	1	0
48	0	0	1	0	1	1	0	1	1	0	0	1	0
49	0	0	1	0	1	1	1	0	1	0	0	1	0
50	0	0	1	0	1	1	0	1	1	0	0	1	0
51	0	0	1	1	0	0	0	0	0	0	0	1	0
52	0	0	1	1	0	0	0	1	1	0	0	1	0
53	0	0	1	1	0	0	1	0	1	0	0	1	0
54	0	0	1	1	0	0	1	1	0	1	0	1	0
55	0	0	1	1	0	1	0	0	0	1	0	1	0
56	0	0	1	1	0	1	0	1	1	1	0	1	0
57	0	0	1	1	0	1	1	0	1	1	0	1	0
58	0	0	1	1	0	1	1	1	0	0	0	1	0
59	0	0	1	1	1	0	0	0	0	1	0	1	0
60	0	0	1	1	1	0	0	1	1	1	0	1	0
61	0	0	1	1	1	0	1	0	1	1	0	1	0
62	0	0	1	1	1	0	1	1	0	0	1	1	0
63	0	0	1	1	1	1	0	0	0	0	1	1	0
64	0	0	1	1	1	1	0	1	1	0	1	1	0
65	0	0	1	1	1	1	1	0	1	0	1	1	0
66	0	0	1	1	1	1	0	1	1	0	1	1	0
67	0	1	0	0	0	0	0	0	0	0	0	1	0
68	0	1	0	0	0	0	0	1	1	0	0	1	0

1. Truth Table lines 69-103

1	2 ⁷ =128	2 ⁶ =64	2 ⁵ =32	2 ⁴ =16	2 ³ =8	2 ² =4	2 ¹ =2	2 ⁰ =1					
2	A3	B3	A2	B2	A1	B1	A0	B0	S0	S1	S2	S3	Count
69	0	1	0	0	0	0	1	0	1	0	1	0	0
70	0	1	0	0	0	0	1	1	0	1	0	1	0
71	0	1	0	0	0	1	0	0	0	1	0	1	0
72	0	1	0	0	0	1	0	1	1	1	0	1	0
73	0	1	0	0	0	1	1	0	1	1	0	1	0
74	0	1	0	0	0	1	1	1	0	0	1	1	0
75	0	1	0	0	1	0	0	0	0	1	0	1	0
76	0	1	0	0	1	0	0	1	1	1	0	1	0
77	0	1	0	0	1	0	1	0	1	1	0	1	0
78	0	1	0	0	1	0	1	1	0	0	1	1	0
79	0	1	0	0	1	1	0	0	0	0	1	1	0
80	0	1	0	0	1	1	0	1	1	0	1	1	0
81	0	1	0	0	1	1	1	0	1	0	1	1	0
82	0	1	0	0	1	1	0	1	1	0	1	1	0
83	0	1	0	1	0	0	0	0	0	0	1	1	0
84	0	1	0	1	0	0	0	1	1	0	1	1	0
85	0	1	0	1	0	0	1	0	1	0	0	0	0
86	0	1	0	1	0	0	1	1	0	1	1	1	0
87	0	1	0	1	0	1	0	0	0	1	1	1	0
88	0	1	0	1	0	1	0	1	1	1	1	1	0
89	0	1	0	1	0	1	1	0	1	1	1	1	0
90	0	1	0	1	0	1	1	1	0	0	0	0	1
91	0	1	0	1	1	0	0	0	0	1	1	1	0
92	0	1	0	1	1	0	0	1	1	1	1	1	0
93	0	1	0	1	1	0	1	0	1	1	1	1	0
94	0	1	0	1	1	0	1	1	0	0	0	0	1
95	0	1	0	1	1	1	0	0	0	0	0	0	1
96	0	1	0	1	1	1	0	1	1	0	0	0	1
97	0	1	0	1	1	1	1	0	1	0	0	0	1
98	0	1	0	1	1	1	0	1	1	0	0	0	1
99	0	1	1	0	0	0	0	0	0	0	1	1	0
100	0	1	1	0	0	0	0	1	1	0	1	1	0
101	0	1	1	0	0	0	1	0	1	0	1	1	0
102	0	1	1	0	0	0	1	1	0	1	1	1	0
103	0	1	1	0	0	1	0	0	0	1	1	1	0

1. Truth Table lines 104-138

	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	$2^7=128$	$2^6=64$	$2^5=32$	$2^4=16$	$2^3=8$	$2^2=4$	$2^1=2$	$2^0=1$					
2	A3	B3	A2	B2	A1	B1	A0	B0	S0	S1	S2	S3	Cout
104	0	1	1	0	0	1	0	1	1	1	1	1	0
105	0	1	1	0	0	1	1	0	1	1	1	1	0
106	0	1	1	0	0	1	1	1	0	0	0	0	1
107	0	1	1	0	1	0	0	0	0	1	1	1	0
108	0	1	1	0	1	0	0	1	1	1	1	1	0
109	0	1	1	0	1	0	1	0	1	1	1	1	0
110	0	1	1	0	1	0	1	1	0	0	0	0	1
111	0	1	1	0	1	1	0	0	0	0	0	0	1
112	0	1	1	0	1	1	0	1	1	0	0	0	1
113	0	1	1	0	1	1	1	0	1	0	0	0	1
114	0	1	1	0	1	1	0	1	1	0	0	0	1
115	0	1	1	1	0	0	0	0	0	0	0	0	1
116	0	1	1	1	0	0	0	1	1	0	0	0	1
117	0	1	1	1	0	0	1	0	1	0	0	0	1
118	0	1	1	1	0	0	1	1	0	1	0	0	1
119	0	1	1	1	0	1	0	0	0	1	0	0	1
120	0	1	1	1	0	1	0	1	1	1	0	0	1
121	0	1	1	1	0	1	1	0	1	1	0	0	1
122	0	1	1	1	0	1	1	1	0	0	1	0	1
123	0	1	1	1	1	0	0	0	0	1	0	0	1
124	0	1	1	1	1	0	0	1	1	1	0	0	1
125	0	1	1	1	1	0	1	0	1	1	0	0	1
126	0	1	1	1	1	0	1	1	0	0	1	0	1
127	0	1	1	1	1	1	0	0	0	0	0	0	1
128	0	1	1	1	1	1	0	1	1	0	0	0	1
129	0	1	1	1	1	1	1	0	1	0	0	0	1
130	0	1	1	1	1	1	0	1	1	0	0	0	1
131	1	0	0	0	0	0	0	0	0	0	0	1	0
132	1	0	0	0	0	0	0	1	1	0	0	1	0
133	1	0	0	0	0	0	1	0	1	0	0	1	0
134	1	0	0	0	0	0	1	1	0	1	0	1	0
135	1	0	0	0	0	1	0	0	0	1	0	1	0
136	1	0	0	0	0	1	0	1	1	1	0	1	0
137	1	0	0	0	0	1	1	0	1	1	0	1	0
138	1	0	0	0	0	1	1	1	0	0	1	1	0

1. Truth Table lines 139-173

1	2 ⁷ =128	2 ⁶ =64	2 ⁵ =32	2 ⁴ =16	2 ³ =8	2 ² =4	2 ¹ =2	2 ⁰ =1					
2	A3	B3	A2	B2	A1	B1	A0	B0	S0	S1	S2	S3	Cout
140	1	0	0	0	1	0	0	1	1	1	0	1	0
141	1	0	0	0	1	0	1	0	1	1	0	1	0
142	1	0	0	0	1	0	1	1	0	0	1	1	0
143	1	0	0	0	1	1	0	0	0	0	1	1	0
144	1	0	0	0	1	1	0	1	1	0	1	1	0
145	1	0	0	0	1	1	1	0	1	0	1	1	0
146	1	0	0	0	1	1	0	1	1	0	1	1	0
147	1	0	0	1	0	0	0	0	0	0	1	1	0
148	1	0	0	1	0	0	0	1	1	0	1	1	0
149	1	0	0	1	0	0	1	0	1	0	1	1	0
150	1	0	0	1	0	0	1	1	0	1	1	1	0
151	1	0	0	1	0	1	0	0	0	1	1	1	0
152	1	0	0	1	0	1	0	1	1	1	1	1	0
153	1	0	0	1	0	1	1	0	1	1	1	1	0
154	1	0	0	1	0	1	1	1	0	0	0	0	1
155	1	0	0	1	1	0	0	0	0	1	1	1	0
156	1	0	0	1	1	0	0	1	1	1	1	1	0
157	1	0	0	1	1	0	1	0	1	1	1	1	0
158	1	0	0	1	1	0	1	1	0	0	0	0	1
159	1	0	0	1	1	1	0	0	0	0	0	0	1
160	1	0	0	1	1	1	0	1	1	0	0	1	0
161	1	0	0	1	1	1	1	0	0	0	0	0	1
162	1	0	0	1	1	1	0	1	1	0	0	0	1
163	1	0	1	0	0	0	0	0	0	0	1	1	0
164	1	0	1	0	0	0	0	1	1	0	1	1	0
165	1	0	1	0	0	0	1	0	1	0	1	1	0
166	1	0	1	0	0	0	1	1	0	1	0	0	1
167	1	0	1	0	0	1	0	0	0	1	1	1	0
168	1	0	1	0	0	1	0	1	1	1	1	1	0
169	1	0	1	0	0	1	1	0	1	1	1	1	0
170	1	0	1	0	0	1	1	1	0	0	0	0	1
171	1	0	1	0	1	0	0	0	0	1	1	1	0
172	1	0	1	0	1	0	0	1	1	1	1	1	0
173	1	0	1	0	1	0	1	0	1	1	1	1	0

1. Truth Table lines 174-207

1	$2^7=128$	$2^6=64$	$2^5=32$	$2^4=16$	$2^3=8$	$2^2=4$	$2^1=2$	$2^0=1$					
2	A3	B3	A2	B2	A1	B1	A0	B0	S0	S1	S2	S3	Cout
174	1	0	1	0	1	0	1	1	0	0	0	0	1
175	1	0	1	0	1	1	0	0	0	0	0	0	1
176	1	0	1	0	1	1	0	1	1	0	0	0	1
177	1	0	1	0	1	1	1	0	1	0	0	0	1
178	1	0	1	0	1	1	0	1	1	0	0	0	1
179	1	0	1	1	0	0	0	0	0	0	0	0	1
180	1	0	1	1	0	0	0	1	1	0	0	0	1
181	1	0	1	1	0	0	1	0	1	0	0	0	1
182	1	0	1	1	0	0	1	1	0	1	0	0	1
183	1	0	1	1	0	1	0	0	0	1	0	0	1
184	1	0	1	1	0	1	0	1	1	1	0	0	1
185	1	0	1	1	0	1	1	0	1	1	0	0	1
186	1	0	1	1	0	1	1	1	0	0	1	0	1
187	1	0	1	1	1	0	0	0	0	1	1	0	1
188	1	0	1	1	1	0	0	1	1	1	0	0	1
189	1	0	1	1	1	0	1	0	1	1	0	0	1
190	1	0	1	1	1	0	1	1	0	0	1	0	1
191	1	0	1	1	1	1	0	0	0	0	1	0	1
192	1	0	1	1	1	1	0	1	1	0	1	0	1
193	1	0	1	1	1	1	1	0	1	0	1	0	1
194	1	0	1	1	1	1	0	1	1	0	1	0	1
195	1	1	0	0	0	0	0	0	0	0	0	0	1
196	1	1	0	0	0	0	0	1	1	0	0	0	1
197	1	1	0	0	0	0	1	0	1	0	0	0	1
198	1	1	0	0	0	0	1	1	0	1	0	0	1
199	1	1	0	0	0	1	0	0	0	1	0	0	1
200	1	1	0	0	0	1	0	1	1	1	0	0	1
201	1	1	0	0	0	1	1	0	1	1	0	0	1
202	1	1	0	0	0	1	1	1	0	0	1	0	1
203	1	1	0	0	1	0	0	0	0	1	0	0	1
204	1	1	0	0	1	0	0	1	1	1	0	0	1
205	1	1	0	0	1	0	1	0	1	1	0	0	1
206	1	1	0	0	1	0	1	1	0	0	1	0	1
207	1	1	0	0	1	1	0	0	0	0	1	0	1

1. Truth Table lines 208-240

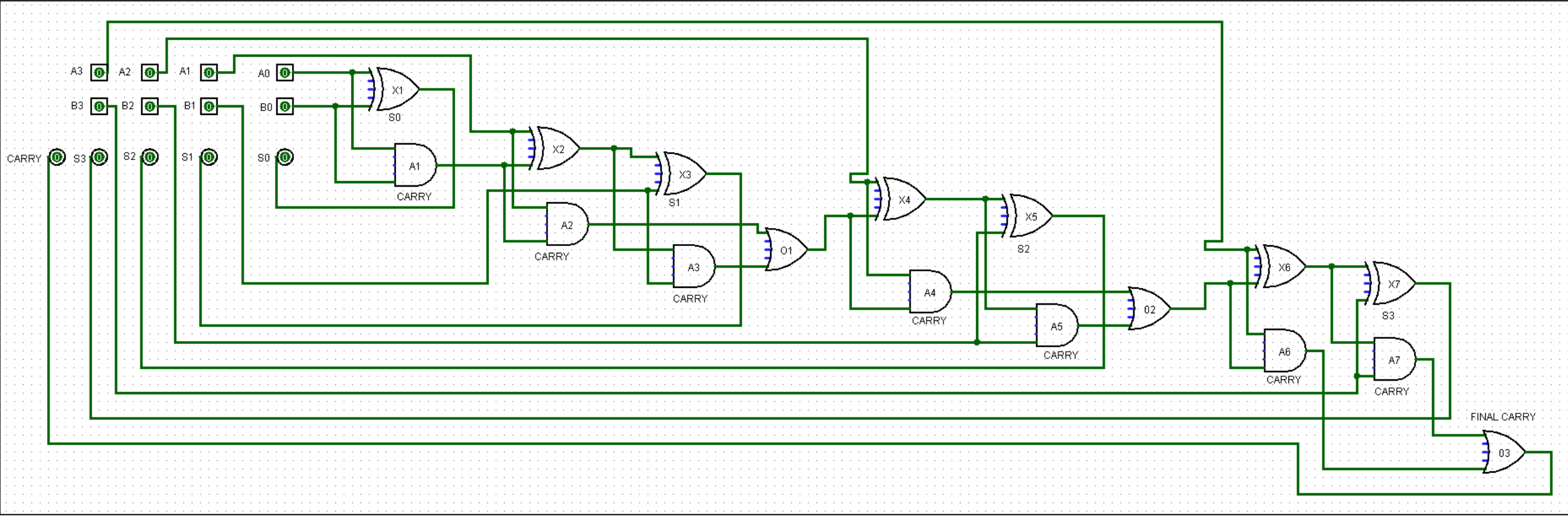
1	2 ⁷ =128	2 ⁶ =64	2 ⁵ =32	2 ⁴ =16	2 ³ =8	2 ² =4	2 ¹ =2	2 ⁰ =1					
2	A3	B3	A2	B2	A1	B1	A0	B0	S0	S1	S2	S3	Cout
208	1	1	0	0	1	1	0	1	1	0	1	0	1
209	1	1	0	0	1	1	1	0	1	0	1	0	1
210	1	1	0	0	1	1	0	1	1	0	1	0	1
211	1	1	0	1	0	0	0	0	0	0	1	0	1
212	1	1	0	1	0	0	0	1	1	0	1	0	1
213	1	1	0	1	0	0	1	0	1	0	1	0	1
214	1	1	0	1	0	0	1	1	0	1	1	0	1
215	1	1	0	1	0	1	0	0	0	1	1	0	1
216	1	1	0	1	0	1	0	1	1	1	1	0	1
217	1	1	0	1	0	1	1	0	1	1	1	0	1
218	1	1	0	1	0	1	1	1	0	0	0	0	1
219	1	1	0	1	1	0	0	0	0	1	1	0	1
220	1	1	0	1	1	0	0	1	1	1	1	0	1
221	1	1	0	1	1	0	1	0	1	1	1	0	1
222	1	1	0	1	1	0	1	1	0	0	0	1	1
223	1	1	0	1	1	1	0	0	0	0	0	1	1
224	1	1	0	1	1	1	0	1	1	0	0	1	1
225	1	1	0	1	1	1	1	0	1	0	0	1	1
226	1	1	0	1	1	1	0	1	1	0	0	1	1
227	1	1	1	0	0	0	0	0	0	0	1	0	1
228	1	1	1	0	0	0	0	1	0	0	1	1	0
229	1	1	1	0	0	0	1	0	1	0	1	0	1
230	1	1	1	0	0	0	1	1	0	1	1	0	1
231	1	1	1	0	0	1	0	0	0	1	1	0	1
232	1	1	1	0	0	1	0	1	1	1	1	0	1
233	1	1	1	0	0	1	1	0	1	1	1	0	1
234	1	1	1	0	0	1	1	1	0	0	0	1	1
235	1	1	1	0	1	0	0	0	0	1	1	0	1
236	1	1	1	0	1	0	0	1	1	1	1	0	1
237	1	1	1	0	1	0	1	0	1	1	1	0	1
238	1	1	1	0	1	0	1	1	0	0	0	1	1
239	1	1	1	0	1	1	0	0	0	0	0	1	1
240	1	1	1	0	1	1	0	1	1	0	0	1	1

1. Truth Table lines 241-256

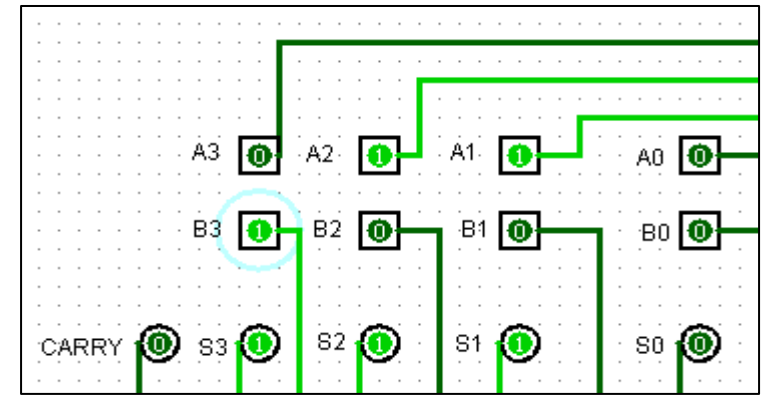
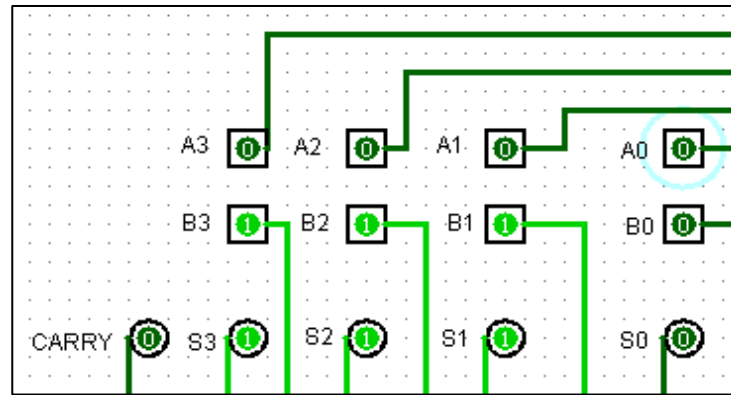
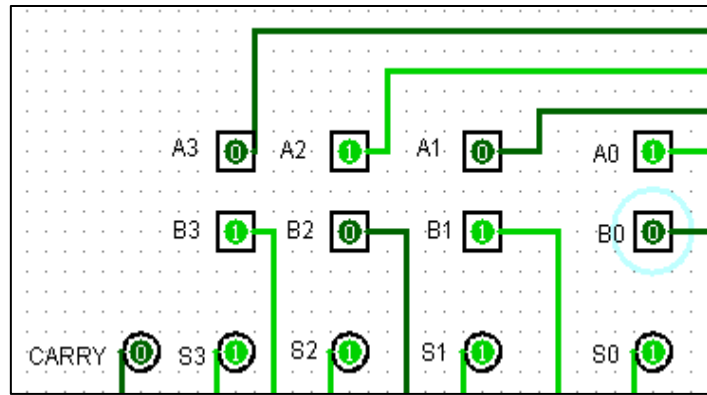
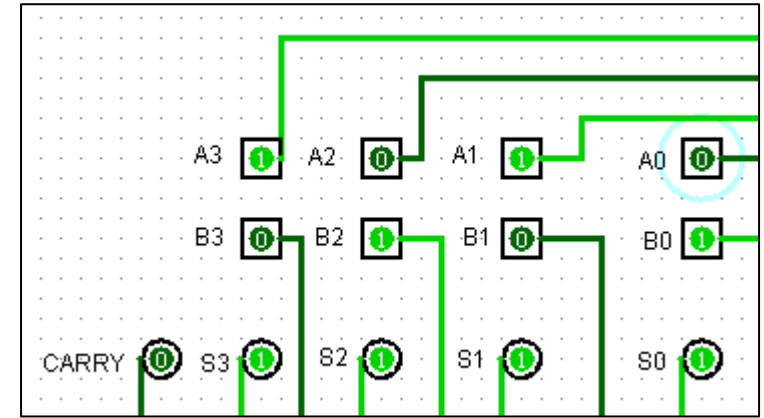
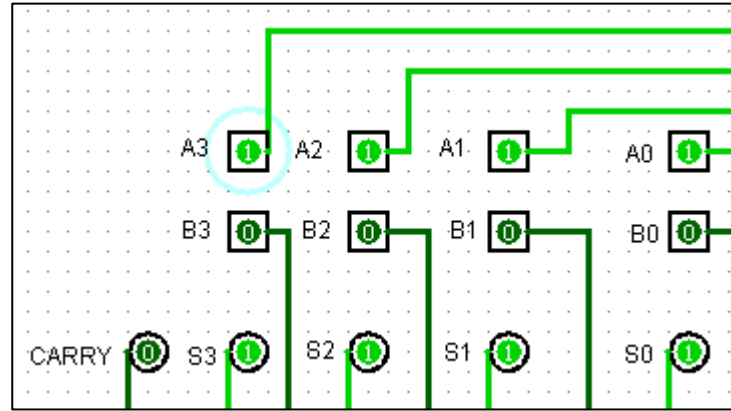
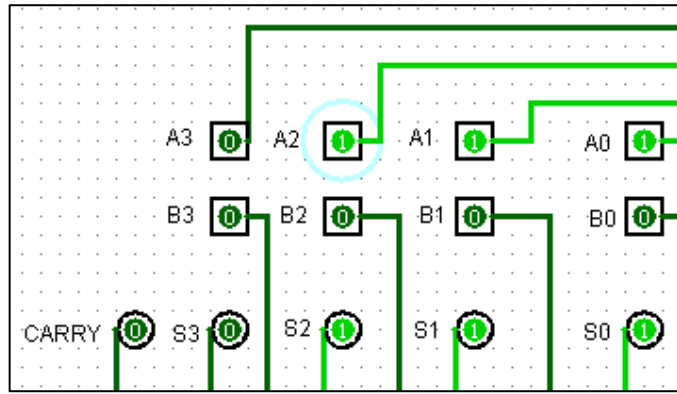
	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	$2^7=128$	$2^6=64$	$2^5=32$	$2^4=16$	$2^3=8$	$2^2=4$	$2^1=2$	$2^0=1$					
2	A3	B3	A2	B2	A1	B1	A0	B0	S0	S1	S2	S3	Count
241	1	1	1	0	1	1	1	0	1	1	0	1	1
242	1	1	1	0	1	1	0	1	1	0	0	1	1
243	1	1	1	1	0	0	0	0	0	0	0	1	1
244	1	1	1	1	0	0	0	1	1	0	0	1	1
245	1	1	1	1	0	0	1	0	1	0	0	1	1
246	1	1	1	1	0	0	1	1	0	1	0	1	1
247	1	1	1	1	0	1	0	0	0	1	0	1	1
248	1	1	1	1	0	1	0	1	1	1	0	1	1
249	1	1	1	1	0	1	1	0	1	1	0	1	1
250	1	1	1	1	0	1	1	1	0	0	1	1	1
251	1	1	1	1	1	0	0	0	0	1	0	1	1
252	1	1	1	1	1	0	0	1	1	1	0	1	1
253	1	1	1	1	1	0	1	0	1	1	0	1	1
254	1	1	1	1	1	0	1	1	0	0	1	1	1
255	1	1	1	1	1	1	0	0	0	0	1	1	1
256	1	1	1	1	1	1	0	1	1	0	1	1	1
257	1	1	1	1	1	1	1	0	1	0	1	1	1
258	1	1	1	1	1	1	0	1	1	0	1	1	1

* It reads 258, but that count includes the two header rows

2. Create a circuit in Logisim that inputs two 4-bit binary numbers, adds them together, and then outputs the result of the addition operation.



4. Provide several (8 or more) examples using different binary values and show the binary arithmetic to confirm your circuit is functioning correctly.



4. More sample illustrations

