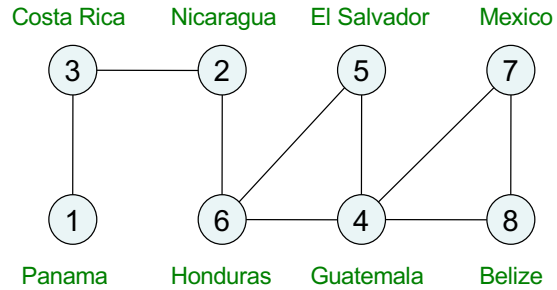


# Lecture 2: Why graphs?

## A cartographer's problem



Graph specified by *nodes* and *edges*.

node = country  
edge = neighbors

**Graph coloring** problem: color nodes of graph with as few colors as possible, so that there is no edge between nodes of the same color.

# Exam scheduling

## The registrar's problem

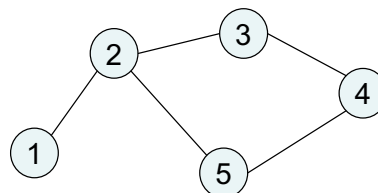
Class	Prereq	Time Slot	Location	Days	Time	Days	Time	Location
101		1	101	1	101	1	101	101
102	101	2	102	2	102	2	102	102
103	101	3	103	3	103	3	103	103
104	101	4	104	4	104	4	104	104
105	101	5	105	5	105	5	105	105
106	101	6	106	6	106	6	106	106
107	101	7	107	7	107	7	107	107
108	101	8	108	8	108	8	108	108
109	101	9	109	9	109	9	109	109
110	101	10	110	10	110	10	110	110
111	101	11	111	11	111	11	111	111
112	101	12	112	12	112	12	112	112
113	101	13	113	13	113	13	113	113
114	101	14	114	14	114	14	114	114
115	101	15	115	15	115	15	115	115
116	101	16	116	16	116	16	116	116
117	101	17	117	17	117	17	117	117
118	101	18	118	18	118	18	118	118
119	101	19	119	19	119	19	119	119
120	101	20	120	20	120	20	120	120
121	101	21	121	21	121	21	121	121
122	101	22	122	22	122	22	122	122
123	101	23	123	23	123	23	123	123
124	101	24	124	24	124	24	124	124
125	101	25	125	25	125	25	125	125
126	101	26	126	26	126	26	126	126
127	101	27	127	27	127	27	127	127
128	101	28	128	28	128	28	128	128
129	101	29	129	29	129	29	129	129
130	101	30	130	30	130	30	130	130
131	101	31	131	31	131	31	131	131
132	101	32	132	32	132	32	132	132
133	101	33	133	33	133	33	133	133
134	101	34	134	34	134	34	134	134
135	101	35	135	35	135	35	135	135
136	101	36	136	36	136	36	136	136
137	101	37	137	37	137	37	137	137
138	101	38	138	38	138	38	138	138
139	101	39	139	39	139	39	139	139
140	101	40	140	40	140	40	140	140
141	101	41	141	41	141	41	141	141
142	101	42	142	42	142	42	142	142
143	101	43	143	43	143	43	143	143
144	101	44	144	44	144	44	144	144
145	101	45	145	45	145	45	145	145
146	101	46	146	46	146	46	146	146
147	101	47	147	47	147	47	147	147
148	101	48	148	48	148	48	148	148
149	101	49	149	49	149	49	149	149
150	101	50	150	50	150	50	150	150

Schedule final exams:

- use as few time slots as possible
- can't schedule two exams in the same slot if there's a student taking both classes.

This is also graph coloring!

Node = exam  
Edge = some student is taking both endpoint-exams  
Color = time slot



# Animal crossing

Animals need to be ferried across a river

- Use as few boats as possible
- Cannot put two animals in the same boat if one will eat the other

This is, yet again, graph coloring!

Node = animal

Edge = one endpoint-animal will eat the other

Color = boat