► **Problem 13.2-19** In addition to the combinations of courses described in Problem 6, suppose there are also students taking all of Geography, Computer Science, Spanish, and French. Does this force a change in the exam schedule? If it does, find a new examination schedule that avoids conflicts and uses that fewest number of periods.

Solution. Certainly, a new schedule is required because, for example, Spanish and French can not be at the same time. Drawing the graph as before and notice that seven vertices B, P, G, CS, S, H, F each two of which are joined by an edge. Thus, at least seven exam periods are necessary. In fact, seven is enough and the chromatic number of the graph is seven. One possible exam schedule which uses seven periods and avoids conflicts is shown below.
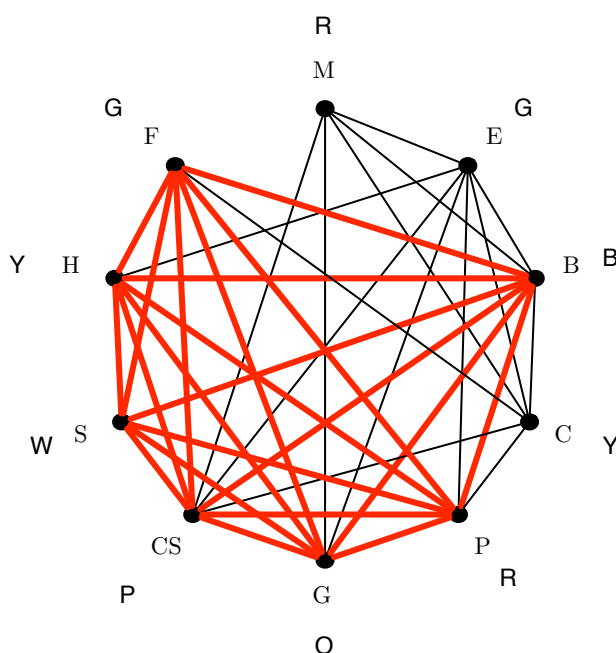
Period 1 (Red)	Mathematics, Psychology
Period 2 (Green)	English, French
Period 3 (Blue)	Biology
Period 4 (Yellow)	Chemistry, History
Period 5 (White)	Spanish
Period 6 (Orange)	Geography
Period 7 (Purple)	Computer Science

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