Modelling with Graphs Summative

February 24, 2020

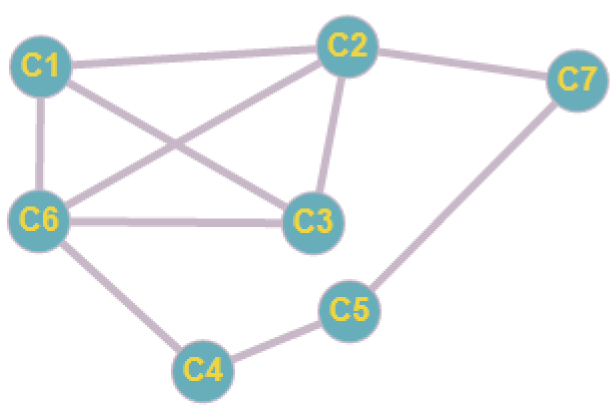
A.3

A.3.1

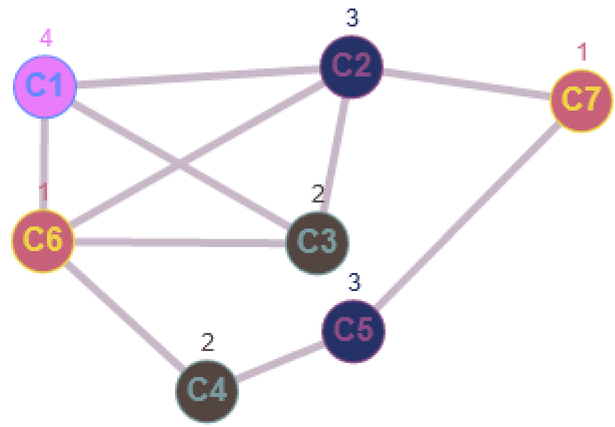
To transform problem A.3 into a graph colouring problem , the problem is represented as a graph where:
Nodes = individual classes $(C_1, ..., C_7)$
Edges = classes with at least one shared student (eg. "Amy" in C_1 and C_5)
Colour = A timeslot
A representation of the graph as an adjacency matrix is:

$$\begin{pmatrix} 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

An example graph would be:



The solution to the problem is the answer to the question, can the graph be coloured in at most 4 colours?
This will solve the problem because if the graph can be coloured so that no neighbouring nodes have the same timeslot then the student can physially attend every class, and by doing it in at most 4 colours means there are sufficient time slots.
An example colouring of the above graph would be:


4
C1
3
C2
1
C7
1
C6
2
C3
3
C5
2
C4