Q1) HW2.1

Use mathematical induction to prove that, for all integers $n>0$,

$$1-2+2^2-2^3+\ldots+(-1)^n 2^n=\frac{2^{n+1}(-1)^n+1}{3}$$

Q2) HW2.2

Each machine part made in a factory is stamped with a code of the form “letter-digit-digit-digit”, where the digits can be repeated. For instance, W065. At least how many parts should be produced to make sure that at least four of them have the same code stamped on them?

Q3) HW2.3
How many different strings can be made by reordering the letters of CORRECT?

Q4) HW2.4
How many different solutions are there to the equation:

$x_1 + x_2 + x_3 + x_4 = 17$ where $x_i \geq 1$

Q5) HW2.5
Solve the following recurrence relation:

$$a_n = 10a_{n-1} - 25a_{n-2} \text{ where } a_0=3, \quad a_1=4.$$

Note: Here, solving means finding a closed-form (non-recursive) equation for an .

Q6) For each of the given pairs below, find the greatest common divisor and tell if these numbers are relatively prime or not?

(i) (210,13)

(ii) (49,154)

Q7) a) What is the inverse of 15 mod 26 ?
b) What is the inverse of 26 mod 15?

Step	x = qy + r	x	y	gcd = ax+by
0	-	26	15	
1				
2				
3				
3				Solve for r. Plug it in.

Q8) We want to guarantee that at least 3 people in a minibus were born in the same month of the year. To guarantee that at least how many people should be on that minibus?

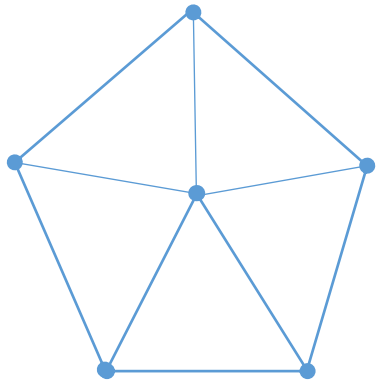
Q9) Relation given in 0-1 matrix below, reflexive? symmetic? asymmetric? anti-symmetric?

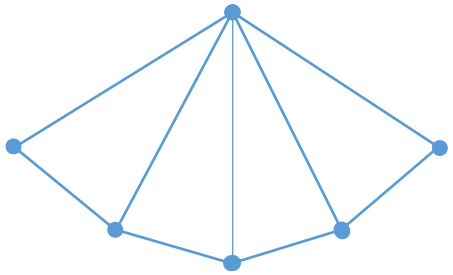
$$\begin{bmatrix} 0 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 0 \end{bmatrix}$$

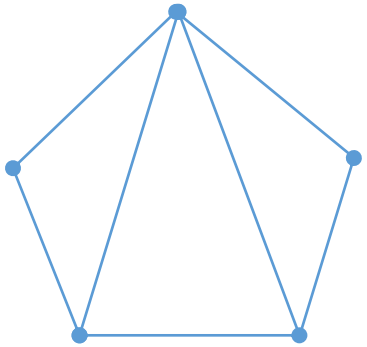
Q10) Assume the matrix given below is an adjacency matrix of an undirected graph *G*.

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

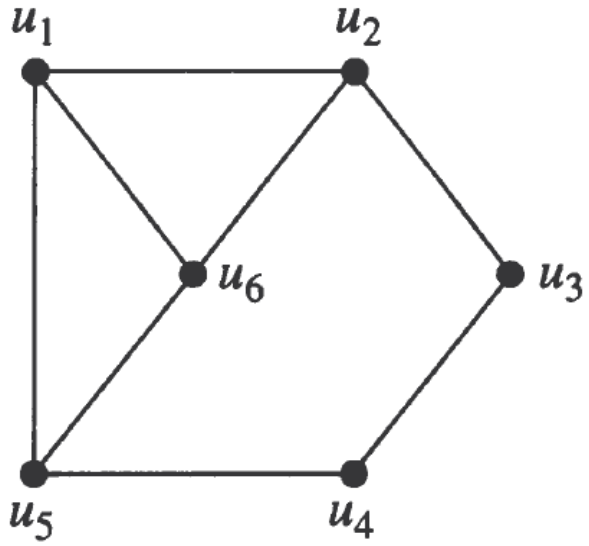
Which one of the following may be *G*? Does *G* have a Euler path or circuit?

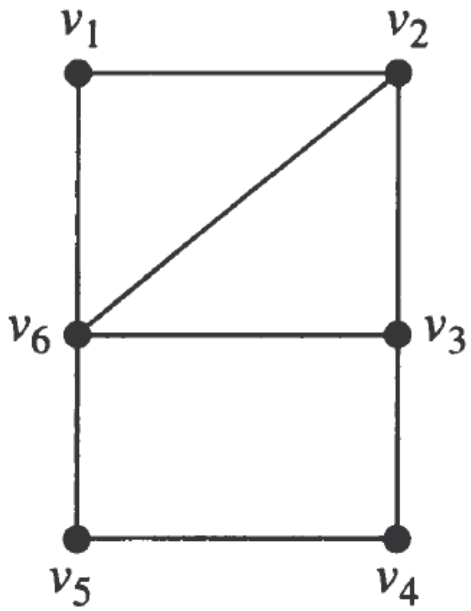






Q11) For the pair given below, determine if the given two graphs are isomorphic? If your answer is yes, then exhibit an isomorphism (which vertex is which). If your answer is no, provide a valid argument that no isomorphism can exists.





Q12) If the relation given below is not transitive, give its transitive closure as a 0-1 matrix.

Hint: You can use a directed graph to understand and solve the question.

	a	b	c	d	e
a	0	1	0	0	0
b	0	0	1	0	1
c	0	0	0	1	1
d	0	0	0	0	0
e	0	0	0	0	0

Q13) Let S be the set of all people in the world and relation R is defined for ordered pairs I.e. $(a,b) \in R$ where a and b are people. If R means 'a weighs more than b', then is (S,R) a partially ordered set?
Explain your answer by discussing the properties of a partially ordered set.

Q14)
Draw the Hasse diagram for the relation R on $A = \{2,3,4,6,10,12,16\}$ where aRb means $a \mid b$.