Coventry University
Assignment Submission & Declaration Form
PLEASE COMPLETE ALL HIGHLIGHTED SECTIONS

Module code: 124MS	**Faculty:** EC
Student ID: 5497124	
Due Date: 23/07/2014 16:00	
Category: Written Report	
Submit Type: Standard	
Assessment Type: Individual	

Surname: Morato Almeida
Forename(s): Vitor
Signed:
Date:

LATE WORK:
If work is being submitted AFTER the deadline a short/long deferral application MUST also have been be submitted for your coursework. Failure to have completed and submitted an application or to supply authorised evidence to support an approved short/long deferral will result in work being awarded a mark of 0%.

Course Title: *Computer Science*	**Cohort / Occurrence Group:** **1314B**
Module Title: *Logic and Sets*	**Assessment Reference no:** **Cw**
Assessment Title:	
Module Leader: *Dr Robert Low*	**Module Tutor:**
Seminar Group / Tutorial Tutor and Group (if different to above):	

I have read the Coventry University rules and regulations on the submission of academic work and in particular the sections concerning misconduct in assessment, including plagiarism and collusion. This assessment is all my (or my group's) own work and has not been copied in part or in whole from any other source, except for any clearly marked up quotations. It complies with the university regulations

I acknowledge that in submitting this work I am declaring that I (or my group) are fit to be assessed and that a deferral may not be applied for following hand in.

I confirm that an electronic version of the item to be assessed (where appropriate) is available and will be provided to the university within 48 hours if requested by the course team.
I confirm that I (or my group) have abided by all applicable Professional Codes of Conduct and I/we will protect confidential information obtained from other individuals.

In respect of group assignments, the submission of this work is made on the basis that all group members are jointly and severally responsible for the work presented for assessment and that by handing in this item for assessment all group members acknowledge and confirm the statements above and cover sheets for all group members are attached.

I understand and accept that upon submitting this work, I will receive an email confirmation of receipt via my University email account.

Mark Awarded	**Feedback Summary** **(see attached sheet for detailed feedback against assessment criteria)**
Mark Signature	

124MS - Coursework 2

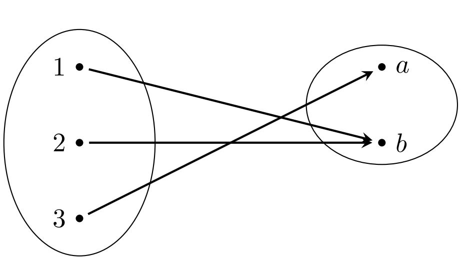
Vitor Morato Almeida

July 23, 2014

1. **The functions f : {1, 2, 3} {a, b} and g : {a, b} {x, y, z} are given by f(1) = b, f(2) = b, f(3) = a, g(a) = y, g(b) = x.**

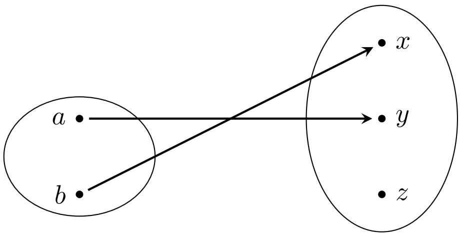
   (a) **Classify each of f and g as bijective, injective, surjective, or neither.**

   Lets draw the mapping diagrams to help to classify each function



f

from the diagram of function f above we can see that every element of the codomain is mapped to by at least one element of the domain, so function f is surjective



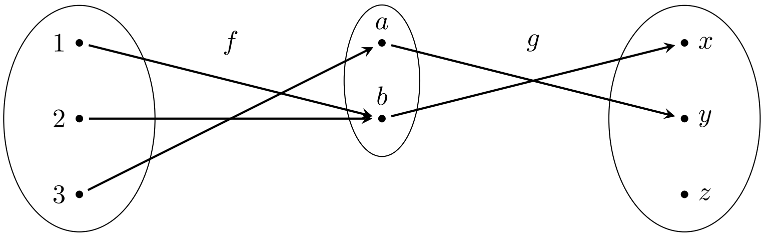
g

from the diagram of function g above we can see that every element of the codomain is mapped to by at most one element of the domain, so function g is injective

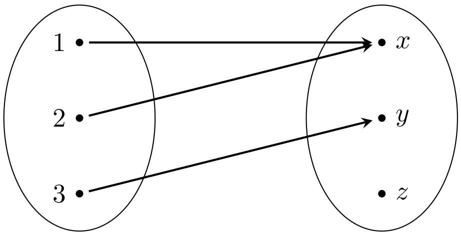
As none of the functions above is simultaneously surjective and injective, we can't classify them as bijective.

   (b) **Find $g \circ f$.**

   This time I'm going to use the previous diagrams to build the diagram of the composition g f



Summarizing the diagram we have,



$g \circ f$

(c) **Either find the inverse of g f or explain why $g \circ f$ is not invertible**

$g \circ f$ is not invertible because it cannot be classified as bijective.

2. **I want to develop a database of information about my book collection, which tells me about the authors and genres of the various books I own. At the moment I have books by Isaac Asimov, China Mieville, Peter F Hamilton and Arthur C Clarke, and I denote the set of authors by A = {A, M, H, C}, abbreviating each author by the initial of his surname. I am classifying the books as science fiction, fantasy, horror and non-fiction, so my set of genres is G = {s, f , h, n}, again using initial letters as abbreviations. At the moment, I have science fiction works by China Mieville and Isaac Asimov, I have fantasy by Peter F Hamilton and China Mieville, horror by Peter F Hamilton and Arthur C Clarke, and non-fiction by Isaac Asimov.**

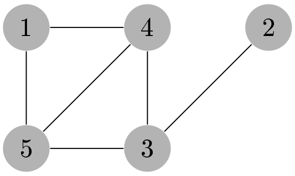
(a) **Give the relation R on A Œ G which represents this information. (You may use appropriate abbreviations.)**

$R = \{(A, s), (A, n), (M, s), (M, f)(H, f), (H, h), (C, h)\}$

3. (a) **Draw the graph with adjacency matrix**

$$\mathbf{A} = \begin{bmatrix} 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 \end{bmatrix}$$

This the graph generated from adjacency matrix:



(b) Calculate A^2 and hence find the number of paths of length 2 from vertex 1 to vertex 5.

$$A \times A \quad = \quad \begin{bmatrix} 2 & 0 & 2 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 \\ 2 & 0 & 3 & 1 & 1 \\ 1 & 1 & 1 & 3 & 2 \\ 1 & 1 & 1 & 2 & 3 \end{bmatrix}$$

Looking at the position (1,5), also (5,1) once this is not a directed graph, we can see that there is only one path of length 2.

7. **Bob decides to use n = 221 = 13 Œ 17 and e = 11 as his public key for an RSA cryptosystem.**

(a) **Show that the decryption exponent is 35.**

To show that 35 is a decryption exponent, we need to check the following condition:

$ed \equiv 1$ (mod z)

To calculate z we use the following formula:

$z = (p - 1)(q - 1)$

replacing the p and q values from question into the formula we have:

$z = (13 - 1)(17 - 1) = 192$

now we calculate ed and its module of 192

$ed = 11 \times 35 = 385$
$385/192 = 2\frac{1}{192} \equiv 1 \text{ (mod z)}$

(b) **Find the encrypted form of the message 16.**

$C = M^e \text{ (mod n)}$
$C = 16^{11}\text{(mod 221)}$

$11 = 8 + 2 + 1$

$16^1 \equiv 35 \text{ (mod 221)}$
$16^2 = 256 \equiv 35 \text{ (mod 221)}$
$16^4 \equiv 35^2 = 1225 \equiv 120 \text{ (mod 221)}$
$16^8 \equiv 120^2 = 14400 \equiv 35 \text{ (mod 221)}$

$C = 16^8 \times 16^2 \times 16 \equiv 35 \times 35 \times 16 = 19600 \equiv 152 \text{ (mod 221)}$