King Saud University	College of Sciences		Department of Mathematics
Second Examination	Math 132	Semester 2 (1445)	Time:1H30

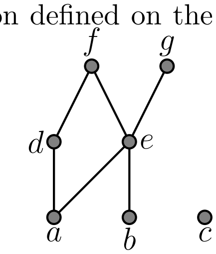
Question 1: (9 marks)

Let $A := \{-2, -1, 1, 2\}$ and $B := \{-1, 0, 2, 3\}$ be two sets.
Let R be the relation from the set A to the set B defined as follows:
for $a \in A$ and $b \in B$, $[(aRb) \Leftrightarrow (2|(a^2 + b^2))]$.
Let S be the relations from B to A defined by $S := \{(-1, -1), (0, 1), (2, -2), (2, 1), (3, -2)\}$.

1. List all the ordered pairs in the relation R. **(2 marks)**
2. Represent the relation R with a matrix. **(1 marks)**
3. Find the relations $S^{-1} \cup R$ and $R - S^{-1}$. **(2 marks)**
4. Find the relations $S \circ R$ and $R \circ S$. **(3 marks)**
5. Draw the digraph of the relation $S \circ R$. **(1 marks)**

Question 2: (7 marks)

1. Let E be the relation on the set $\mathbb{R}$ (real numbers) defined by:
   for $x, y \in \mathbb{R}$, $(xEy) \Leftrightarrow (\sqrt{x} - \sqrt{y}) \in \mathbb{Z}$.
   (a) Prove that the relation E is an equivalence relation on $\mathbb{R}$. **(3 marks)**
   (b) Show that $\left[\frac{1}{4}\right] \neq \left[\frac{1}{9}\right]$. **(1 marks)**
2. Let P be the partial ordering relation defined on the set $C := \{a, b, c, d, e, f, g\}$ represented by the following Hasse diagram:



   (a) List all the ordered pairs in the relation P. **(2 marks)**
   (b) Is P a total ordering? **(1 marks)**

Question 3: (9 marks)

1. Consider the function F from the set $X := \{0, 1, 2, 3, 4\}$ to $Y := \{a, b, c, d\}$, defined by: $f(0) = f(1) = c$, $f(2) = b$ and $f(3) = f(4) = d$.
   (a) Find the image of each of the sets $\{0, 1\}$ and $\{2, 3, 4\}$. **(1 marks)**
   (b) Find the inverse image of each of the sets $\{c, b\}$ and $\{d\}$. **(1 marks)**
   (c) Determine whether f is one-to-one, or it is onto Y. (Justify your answer). **(2 marks)**
2. Let g and h be two functions from $\mathbb{R}$ to $\mathbb{R}$, defined by $g(x) = 3x - 5$ and $h(x) = x^2 - 2$.
   (a) Show that g is a one to one correspondence and find $g^{-1}(y)$, for all $y \in \mathbb{R}$.**(2+1 marks)**
   (b) Find $h \circ g$ and $g \circ h$.**(2 marks)**