CMSC 57: Discrete Mathematical Structures in Computer Science 2
Exercise 9: Algebraic Structures

On your papers, write your name, student number, section, the date today and your animal totem if you were an Indian (totem = guiding animal spirit).

A. For every given below, determine which kind of algebraic structure it is, and **give at least one proof** of why it is not of the higher structure (e.g. It is a semigroup but not a monoid because it doesn't have an identity element, etc).
If it is a semigroup, **show associativity**.
If it is a commutative semigroup, **show commutativity.**
If it is a monoid, **identify the identity element**.
If it is a group, **identify the inverse element**.
if it is an abelian group, **show commutativity**.

*		b				
		2	**4**	**6**	**8**	**10**
a	**2**	2	4	6	8	10
	4	4	6	8	10	2
	6	6	8	10	2	4
	8	8	10	2	4	6
	10	10	2	4	6	8

1. A = {2,4,6,8,10}, (a*b) is illustrated by the table on the right
2. A = Z^+, (a*b) = a+b
3. A = Z^+ + {0}, (a*b) = a·b
4. A = Q^+, (a*b) = ((a·b)/11) + 3
5. A = Q^+, (a*b) = (a·b)/11
6. A = {1,2,...,100}, (a*b) = |a-b|
7. A = {1, -1, i, -i}, (a*b) = a·b
8. A = Z^+, (a*b) = a+b
9. A = set of positive even numbers, (a*b) = (a·b)/2
10. A = set of positive odd numbers, (a*b) = 2(a·b) + 1

B. For each **group structures** identified above, give a single cyclic subgroup generated by a $\in$ A (pick only one element a from A). Show at least 7 elements generated by the element.

CMSC 57: Discrete Mathematical Structures in Computer Science 2
Exercise 9: Algebraic Structures

On your papers, write your name, student number, section, the date today and your animal totem if you were an Indian (totem = guiding animal spirit).

A. For every given below, determine which kind of algebraic structure it is, and **give at least one proof** of why it is not of the higher structure (e.g. It is a semigroup but not a monoid because it doesn't have an identity element, etc).
If it is a semigroup, **show associativity**.
If it is a commutative semigroup, **show commutativity.**
If it is a monoid, **identify the identity element**.
If it is a group, **identify the inverse element**.
if it is an abelian group, **show commutativity**.

*		b				
		2	**4**	**6**	**8**	**10**
a	**2**	2	4	6	8	10
	4	4	6	8	10	2
	6	6	8	10	2	4
	8	8	10	2	4	6
	10	10	2	4	6	8

1. A = {2,4,6,8,10}, (a*b) is illustrated by the table on the right
2. A = Z^+, (a*b) = a+b
3. A = Z^+ + {0}, (a*b) = a·b
4. A = Q^+, (a*b) = ((a·b)/11) + 3
5. A = Q^+, (a*b) = (a·b)/11
6. A = {1,2,...,100}, (a*b) = |a-b|
7. A = {1, -1, i, -i}, (a*b) = a·b
8. A = Z^+, (a*b) = a+b
9. A = set of positive even numbers, (a*b) = (a·b)/2
10. A = set of positive odd numbers, (a*b) = 2(a·b) + 1

B. For each **group structures** identified above, give a single cyclic subgroup generated by a $\in$ A (pick only one element a from A). Show at least 7 elements generated by the element.