

**QUIZ 1**

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(1) Let  $R = \mathbb{Z}_{15}$  (the ring of integers modulo 15).

(a) List all the invertible elements in  $R$ .

(b) List all the zero-divisors in  $R$ .

(c) List all the idempotents in  $R$ .

(d) Let  $S = \{0, 3, 6, 9, 12\} \subset R$ . Is  $S$  a subring of  $R$ ?

(e) Let  $S = \{0, 1, 2, 4, 6, 8, 10, 12, 14\} \subset R$ . Is  $S$  a subring of  $R$ ?

(2) Which of the following maps is a ring homomorphism:

(a)  $f: \mathbb{Z} \rightarrow \mathbb{Z}$ , defined by  $f(x) = -x$ .

(b)  $f: \mathbb{Z}_6 \rightarrow \mathbb{Z}_3$ , defined by  $f([x]_6) = [x]_3$ , where  $[u]_n$  denotes the class of the integer  $u$  in  $\mathbb{Z}_n$ .