

6 Cryptography (mgk25)

- (a) (i) Choose and briefly describe one major application of elliptic-curve group operations in cryptography. [4 marks]
- (ii) What other group operation was previously (and still is) widely used for the same purpose? [2 marks]
- (iii) What is a major advantage of elliptic curve group operations over the group operation you named in Part (a)(ii)? [4 marks]
- (b) In the Galois field $\text{GF}(2^8)$ modulo $x^8 + x^4 + x^3 + x^2 + 1$, calculate
- (i) the sum 0011 1001 plus 0110 1100; [2 marks]
- (ii) the product 0100 1011 times 0000 1001. [4 marks]
- (c) In Lamport's one-time password scheme, the user is given a list of passwords R_n, \dots, R_0 generated using the following algorithm:

```
 $R_0 \leftarrow \text{random}$   
for  $i := 1$  to  $n$   
     $R_i := h(R_{i-1})$ 
```

- (i) State two properties required of function h . [2 marks]
- (ii) Complete the password verification algorithm implemented in the server by filling in the ellipses (...) below:

```
 $Q := \dots$   
while true  
     $P := \text{read password}$   
    if ...  
        ...  
        grant access  
    else  
        deny access
```

[2 marks]