① 0000 - 0
0001 - 1
0011 - 2
0010 - 3
0110 - 4
0111 - 5
0101 - 6
0100 - 7
1100 - 8
1101 - 9
1111 - 10
1110 - 11
1010 - 12
1011 - 13
1001 - 14
1000 - 15

② (a) 1 1 0 1 1 0 1 1 0
1 0 1 1 1 0 1 1 0 1
change 1+1+1+1+1+1 = 6

1 0 1 1 0 1 1 0 1
0 1 1 0 1 1 0 1 1
1+1+1+1+1+1 = 6

the distance in the code is 6 = m

(b) 111111111

(c) 000000000

(d) using the formula
$m = 2c + d + 1$
$m = 6 \quad 6 = 2c + d + 1$
Various options:
- c = 2 d = 1
- c = 1 d = 3
- c = 0 d = 5

③ The code distance for gray code = 1
m = 1
insert into the formula:
$1 : 2c + d + 1$
$0 : 2c + d$
from here we can see that it is not possible for it to detect any errors
so therefore it cannot correct any problem either.

④ good luck!
g - 1100111 1
o - 1101111 0
o - 1101111 0
d - 1100100 1
space - 0100000 1
! - 0100010 0
k - 1101011 1
l - 1101100 0
u - 1110101 1
c - 1100011 0

⑤ number of bits that we need is $2^{12} = 4096 \rightarrow$ 12 bits in order for us to count to 3000, in order for us to allow a correction of an error we need to add another 4 parity bits. 12 + 4 = 16 but at 16 there is a parity bit so we add one more, 11 + 1 = 17

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

1, 2, 4, 8 ← (numbers that are to the power of 2)

Parity bit