Unless stated otherwise, variables are integers.

1. One way to add k bits is to increase the sum by 1 each time a bit is 1. How long does this method take? Hint: what is the runtime of the following algorithm?

```
def bincount(k):  # n >= 0
  for j in range(k+1):
    print bin(j)
```

2. Consider binary multiplication using the school algorithm. Assume each of the two inputs has k bits.

   (i) What is the runtime if the rows are added one at a time? i.e. add the first two rows, then add that sum to the next row, etc.

   (ii) What is the runtime if the rows are added column by column?

3.
```
def d2b(n): #n >= 0
  if (n==0):
      return '0'
  if (n==1):
    return '1'
  return d2b(n/2)+d2b(n%2)
```

   (i) Trace with $n = 37$.

   (ii) What does the algorithm do?

   (iii) Give runtime, as a function of n.

   (iv) Prove correctness.

4. Trace peasant multiplication with inputs 907 658.