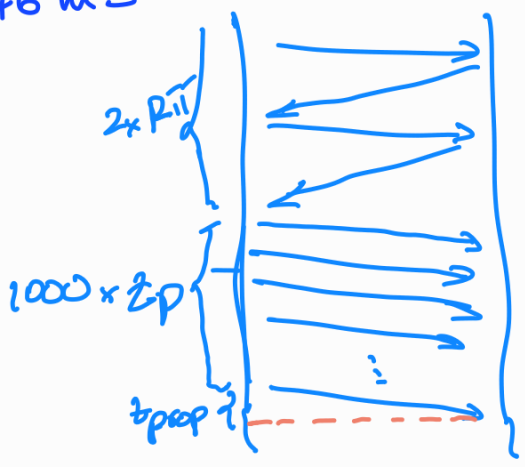
1. $1KB \left| \frac{1024B}{1KB} \right| \frac{8bits}{1B} \Big| = 8,192$ bits.

1.1 time-per-packet

$$t_p = \frac{8,192 \text{ bits}}{1.5 \times 10^6 \frac{\text{bits}}{\text{sec}}} = 5.46 \text{ ms}$$



propagation time.

$$t_{prop} = \frac{1}{2} RTT$$

Total time

$$T = 2 \times RTT + 1000 \times t_p + t_{prop}.$$

$$= 2.5(100) + 1000(5.46).$$

$$= 250 + 5460$$

$$= 5710 \text{ ms}$$

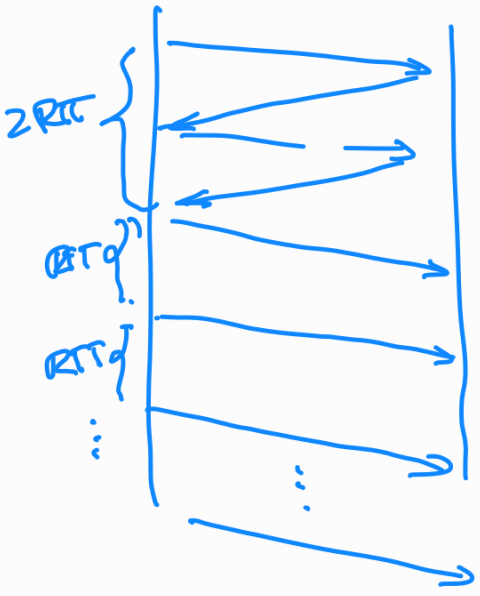
$$= 5.71 \text{ sec}.$$

1.2.

$$T = 2 \times RTT + 1000 \times t_p + t_{prop} + 999 \times RTT$$

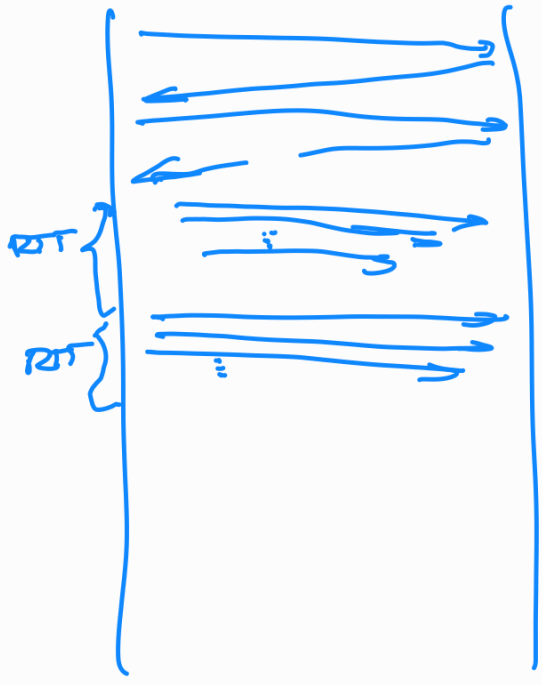
$$= 5.71 + 99.9$$

$$= 105.61 \text{ sec}.$$



1.3 $\frac{1000}{20} = 50$.

For the last group of 20 we need only 1/2 RTT of propagation



$T = 2 * RTT + 49\ RTT + \frac{1}{2} RTT$

$= 51.5\ (100)$

$= 5.15$ sec.

1.4 $1 + 2 + 4 + 8 + \ldots + 512. = 1023.$ (489)

$\log_2 512 = 9.$

$T = 2 * RTT + 9 * RTT + \frac{1}{2} RTT$

$= 11.5\ RTT$

$= 1.15$ sec.

2. > Each address should have a component that allows for grouping of several addresses close to each other. For example, the postal code in a mailing address. This helps letters to be routed faster.

> If we want to send a message to all or a group of devices, we should have special addresses that allows us to do this

3. 1. Open a file: delay sensitive, only opening.

2. Read contents: Bcs sensitive.

3. List the contents of a directory - delay sensitive

4. Display the attributes of a file - delay sensitive.

4.

$$\#\ \text{packets} = \frac{1 \times 10^6}{\text{packet data size}}$$

$$\text{lost bytes} = \text{packet data size}$$

packet size	total overhead + lost bytes
1,000	$100 \times \frac{10^6}{1{,}000} + 1{,}000 = 101{,}000$
5,000	$100 \times \frac{10^6}{5{,}000} + 5{,}000 = 25{,}000$
10,000	$100 \times \frac{10^6}{10{,}000} + 10{,}000 = 20{,}000$ ⇐ optimal
20,000	$100 \times \frac{10^6}{20{,}000} + 20{,}000 = 25{,}000$

5. 11001001 x^3+1

5.1

```
1100'1001000 | 1001
1001           ------
-----          1101001
 0101
  1001
 -----
  001000
    1001
   ------
    000100
      1001
     -----
      01010
       1001
      -----
       0011
```

remainder

message: 1101 001 011

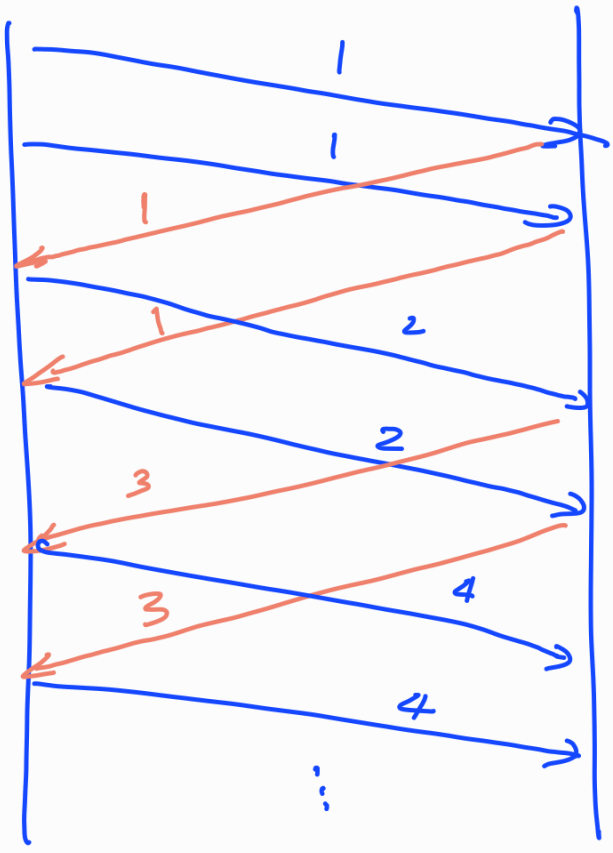
5.2

```
1001'001011 | 1001
1001          -------
-----         1000001
  001011
   1001
  ------
   0010
```

remainder ≠ 0 → error.

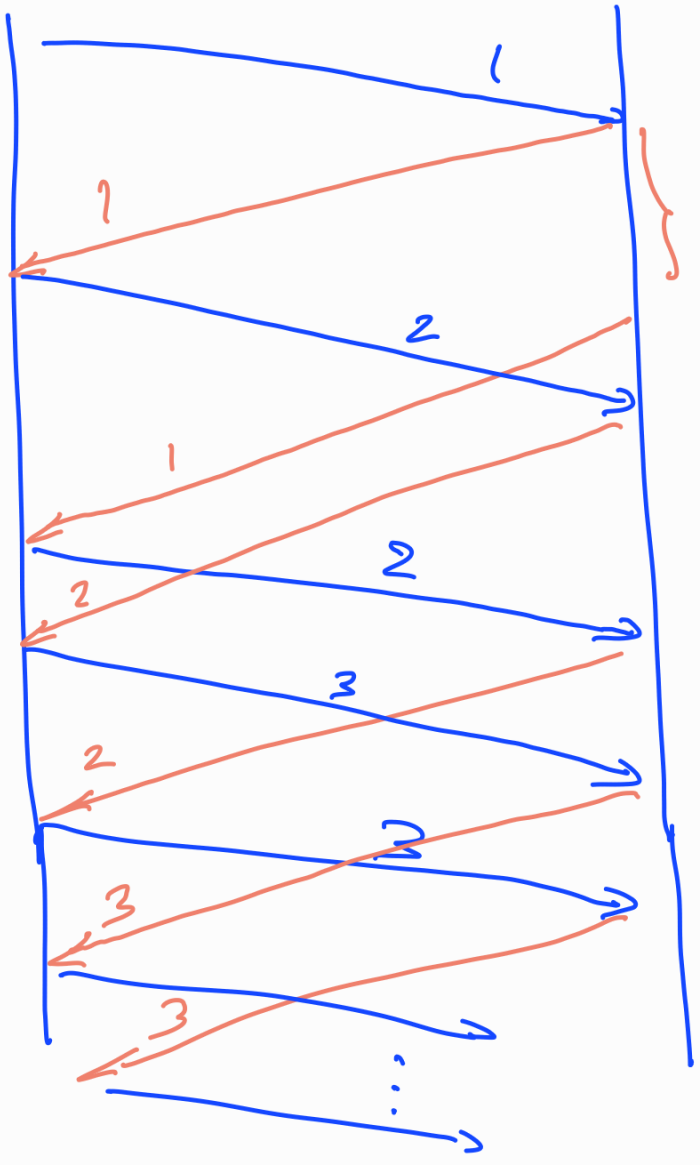
6.

6.1



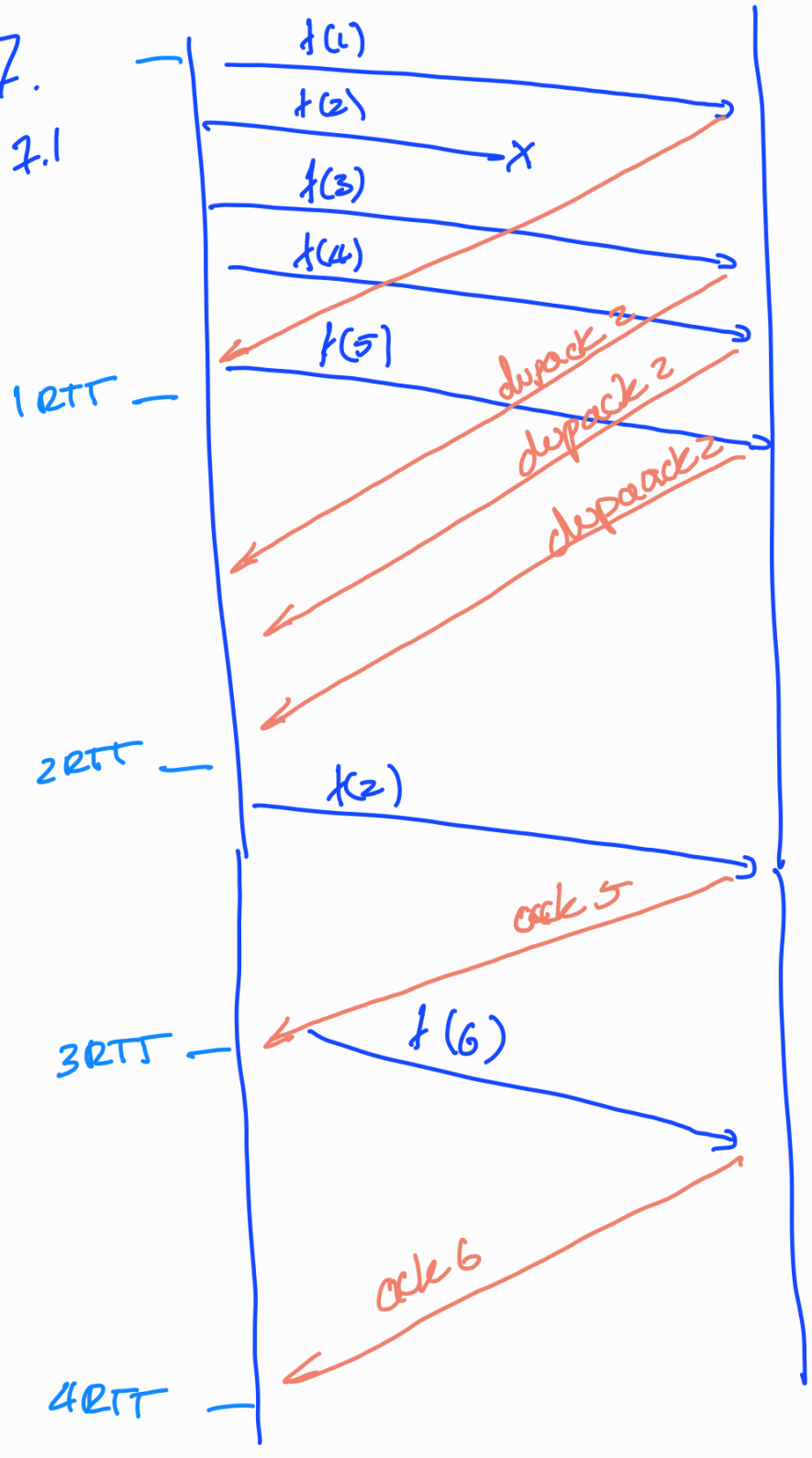
it doesn't stop.

6.2

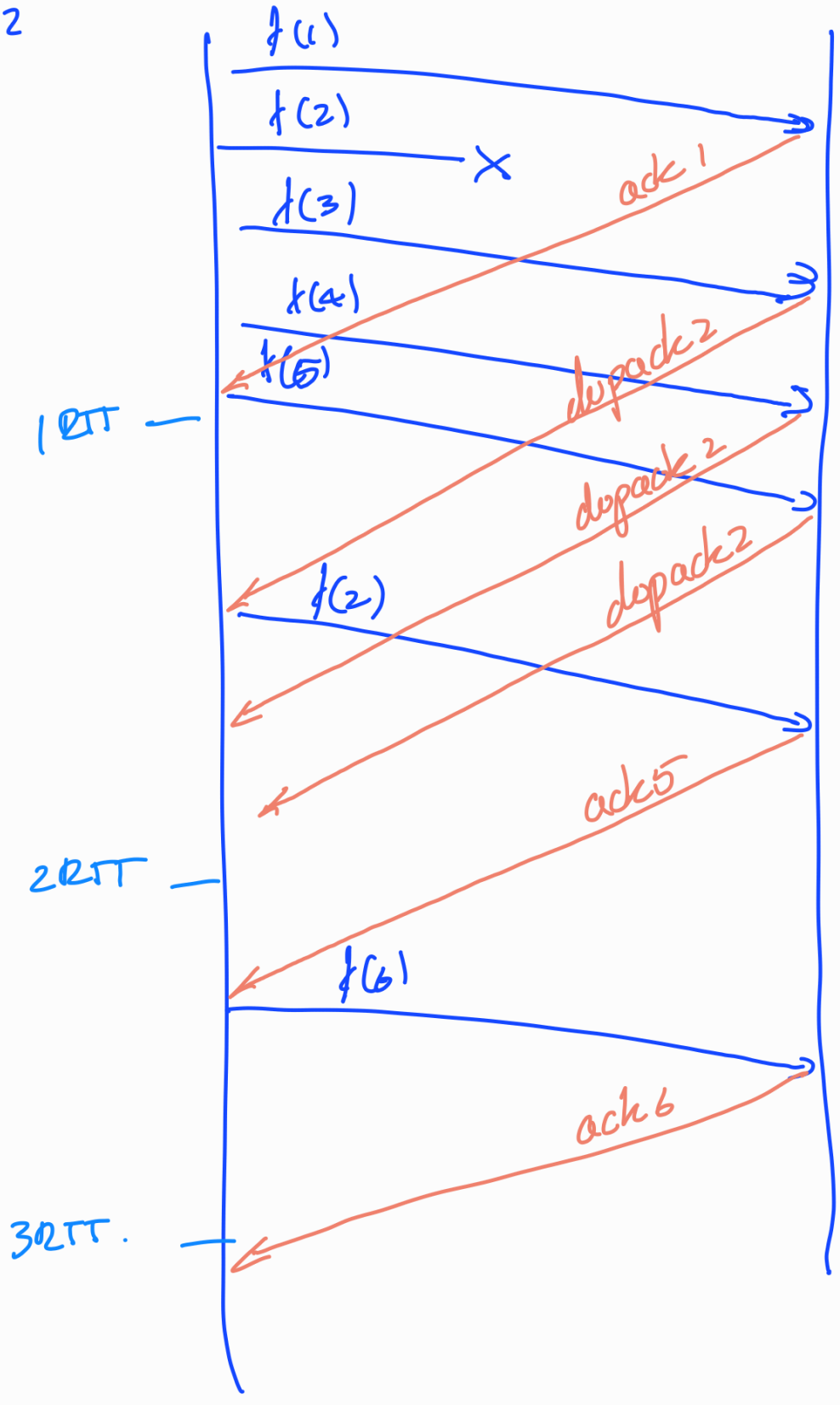


7.

7.1


1(1)
1(2)
X
1(3)
1(4)
1(5)
dupack 2
dupack 2
dupack 2
1RTT
2RTT
1(2)
ack 5
3RTT
1(6)
ack 6
4RTT

7.2


f(1)
f(2)
X
ack 1
f(3)
f(4)
f(5)
dupack 2
1RTT
dupack 2
dupack 2
f(2)
ack 5
2RTT
f(6)
ack 6
3RTT.