Question 1:

The Steps are as follows

D-D, C-D, D-L, X-UL, B-LDR, D-U, X-LUR

Option: c) 0,3,1,3,0,5 and 7

Question 2:

First, realize that the total points awarded is 40. Given that we are dealing with integers that means the total number of Events (TE) times the total number of points awarded in an event (TP) must equal 40. We can quickly eliminate some possibilities.

Events (TE)	Points (TP)	
1	40	Not possible since we know there are at least two events
2	20	Not possible since Gryffindor and Slytherin both won 1 event. There would be no way for Slytherin and Ravenclaw to finish with the same points.
4	10	A possibility
5	8	A possibility
8	5	Not possible, since 1st>2nd>3rd>0 means the minimum number of points awarded HAS to be 6 (3, 2, 1)
10	4	Same Reason
20	2	Same Reason
40	1	Same Reason

So we now know it was either 4 events with 10 points awarded in an event or 5 events with 8 points awarded. Let's look at the 4/10 situation first. The possible points for each place with 10 overall points available is (all other combinations are impossible because of the 1st>2nd>3rd>0 constraint):

- 5, 3, 2 : Not possible as there is no way to get to 22 points in 4 events (greatest possible points would be 20)
- 5, 4, 1 : Same reason
- 6, 3, 1 : Not possible, since no combination of 4 numbers can get to 22 points (3 ×6+3= 21, 4 ×6=24)
- 7, 2, 1 : A possibility – let's look further.

Can we get Gryffindor to 22? Yes. Gryffindor can finish 1st 3 times and 3rd once (in the Quidditch). 3 ×7+1 = 22.

Can we get Slytherin to 9? Nope. Slytherin won the Quidditch (7 points). There's no way to get to 9 with the remaining event/point combinations. Sooooo …

There must be 5 events with a total of eight points (we're getting close). Let's look at the possible points (again, the other combinations are not possible because of the 1st>2nd>3rd>0 constraint):

- 4, 3, 1 : Not possible as there is no way to get to 22 points (4 ×5=20 is maximum)
- 5, 2, 1 : Looks like this is the winner. Let's check.

Can we get Gryffindor to 22? Yes. Gryffindor can finish 1st 4 times and 2nd once (4 ×5+2). Since we know Slytherin finished 1st in the Quidditch, Gryffindor must have finished 2nd.

Can we get Slytherin to 9? Yes. Slytherin finished 1st in the Quidditch (5 points) and finished 3rd 4 times (4 ×1) for a total of 9 points.

Can we get Ravenclaw to 9? Yes. Ravenclaw finished 3rd in the Quidditch (1 point) and must have finished 2nd in the 4 other events (4 ×2) for a total of 9 points.

Since Ravenclaw finished 2nd in EVERY EVENT OTHER THAN THE QUIDDITCH, he MUST have finished 2nd in the O.W.Ls. Here is a little table:

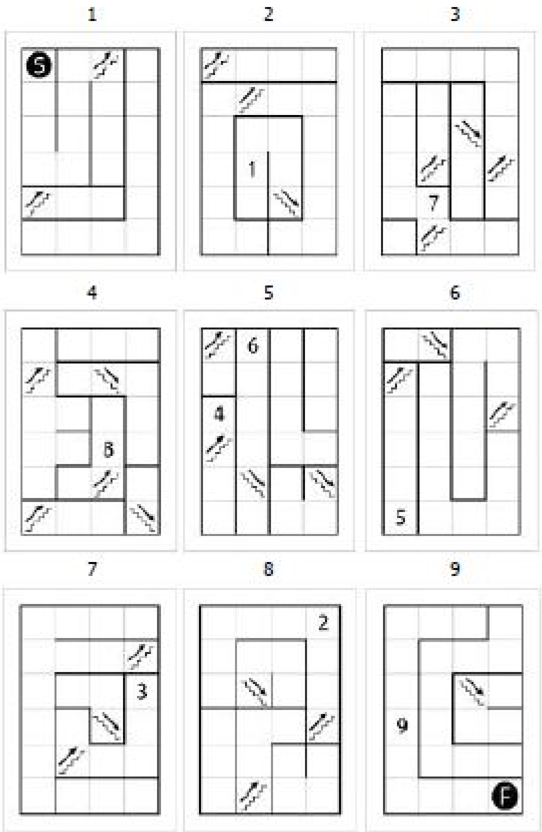
	Quidditch	Event 2	Event 3	Event 4	O.W.Ls	Total
Gryffindor	2nd (2 pts)	1st (5 pts)	1st (5 pts)	1st (5 pts)	1st (5 pts)	22 pts
Slytherin	1st (5 pts)	3rd (1 pt)	3rd (1 pt)	3rd (1 pt)	3rd (1 pt)	9 pts
Ravenclaw	3rd (1 pt)	2nd (2 pts)	2nd (2 pts)	2nd (2 pts)	2nd (2 pts)	9 pts

Question 3:

Consider the odd number of cards as red, and the ven number as green , calculate the sum of all red and green cards. If the sum of red cards is greater than the sum of green cards, then pick the red card from the red end. The second player will have a choice of picking a green card from either end, which would lead to us picking the red card in the next turn. This would ensure that we end up with all the red cards, whose sum is clearly reater.

Question 4:

The correct order is given below



Question 5;

The above document is a table which has the ISO 3166-1 Alpha-2 Country Codes and the list of capital cities.

This Gives us the second jumbled string:
OWUHSSYMSCFR RDSSZLPA

On Decoding the first string using a Playfair cipher with I = J and the key text LIFE yields:

MY PASSWORD IS

Decoding the second string using a Playfair cipher with I = J and the key text DEATH yields:

PASSWORD

To show an example of the second cipher at work:

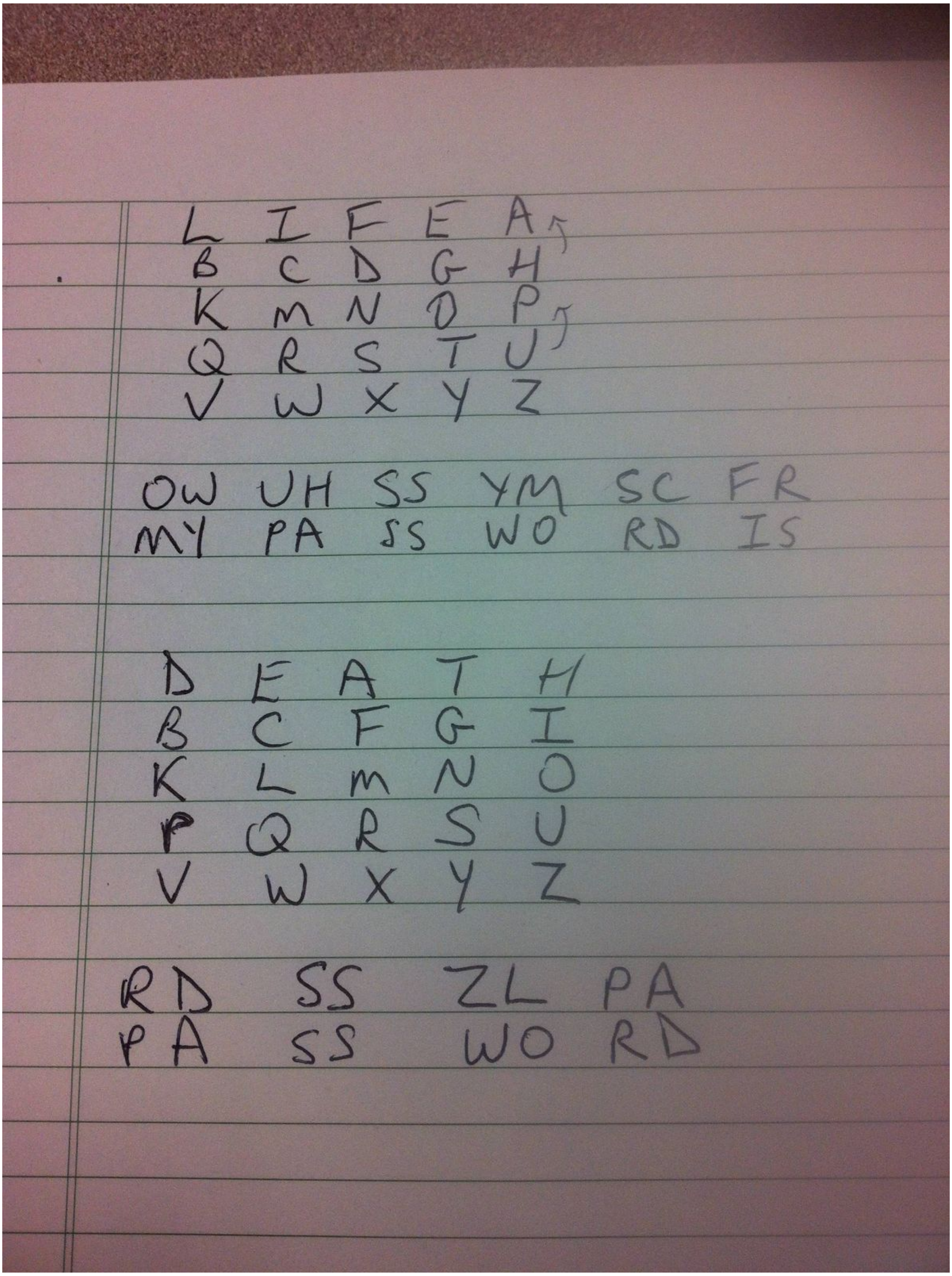
D	E	A	T	H
B	C	F	G	I
K	L	M	N	O
P	Q	R	S	U
V	W	X	Y	Z

All of the letters are entered into the tableau starting with the letters of the key and then the rest of the 26 letters. If a letter would be listed a second time because it was already listed in the key, it is omitted. The letter I is equivalent to the letter J for the purposes of Playfair. Other implmentations just omit Q.

Each pair of letters in the input text forms a rectangle. The opposite two corners of the rectangle are the decrypted text.

See how RD decrypts to PA in the first image. The second image shows how ZL is decrypted to WO. PA decrypts to RD as it is the opposite of the first image.

D	E	A	T	H
B	C	F	G	I
K	L	M	N	O
P	Q	R	S	U
V	W	X	Y	Z


L I F E A
B C D G H
K M N O P
Q R S T U
V W X Y Z
OW UH SS YM SC FR
MY PA SS WO RD IS
D E A T H
B C F G I
K L M N O
P Q R S U
V W X Y Z
RD SS ZL PA
PA SS WO RD

Sum is **296**

Question 6:

For a 2x 10 room, Total ways of tiling : **1255**

Question 7,8:

56	=>	3
39	=>	9

Best possible way is hit and trial while using logic.

Question 9:
This question is a modification of the N-queens problem. For more information regarding N-queens problem visit, https://en.wikipedia.org/wiki/Eight_queens_puzzle

Question 10:

SOLUTION
N=**6**
No of moves is **45**

Let the disks be numbered 1,...,N1,...,N from smallest to largest. Without loss of generality (WLOG), suppose they are all on peg A at the start.

Disks N and N−1 are different colors, so at a minimum you must move disk N−1 off of disk N and onto another peg. WLOG, suppose you decide to move disk N−1 to peg B. In order to do that, you must first move disks 1,...,N−21,...,N−2 to peg C.

So now you have disk N on peg A, disk N−1 on peg B, and all the other disks on peg C. You have to get disk N−2 onto peg A. But in order to do this you have to move all the smaller disks from peg C to peg B . Do all of this, so now you have disks N and N−2 on peg A and all the other disks on peg B.

Fortunately, you do not have to move disk N−3 again, because it is already exactly where you want it (on top of disk N−1). In fact, you now have the same problem you started out with, but with N−2 disks on peg B instead of N disks on peg A, and you need to move disk N−3 to peg A

we can make a recursive algorithm out of this, with the recursion occurring each time the number of disks to move is reduced by 2. Likewise, we can make a recursive formula to compute how many moves the algorithm will require.

Question 11:

Answer = **12** configurations are possible.

$$\begin{array}{ccccc} 1 & - & 2 & - & 3 \\ & & & & \| \\ 2 & = & 3 & - & 3 \end{array}$$

$$\begin{array}{ccccc} 1 & - & 3 & = & 3 \\ & & & & | \\ 2 & = & 3 & - & 2 \end{array}$$

$$\begin{array}{ccccc} 1 & - & 3 & - & 3 \\ & & | & & \| \\ 2 & = & 3 & & 2 \end{array}$$

$$\begin{array}{ccccc} 1 & & 2 & - & 3 \\ | & & | & & \| \\ 2 & - & 3 & - & 3 \end{array}$$

$$\begin{array}{ccccc} 1 & & 3 & = & 3 \\ | & & | & & | \\ 2 & & 3 & - & 2 \end{array}$$

$$\begin{array}{ccccc} 1 & & 2 & = & 3 \\ | & & & & | \\ 2 & - & 3 & = & 3 \end{array}$$

$$\begin{array}{ccccc} 1 & & 3 & = & 3 \\ | & & \| & & \| \\ 2 & - & 3 & & 2 \end{array}$$

$$\begin{array}{ccccc} 1 & & 2 & - & 3 \\ | & & | & & \| \\ 3 & = & 3 & & 2 \end{array}$$

$$\begin{array}{ccccc} 1 & & 2 & = & 3 \\ | & & & & | \\ 3 & = & 3 & - & 2 \end{array}$$

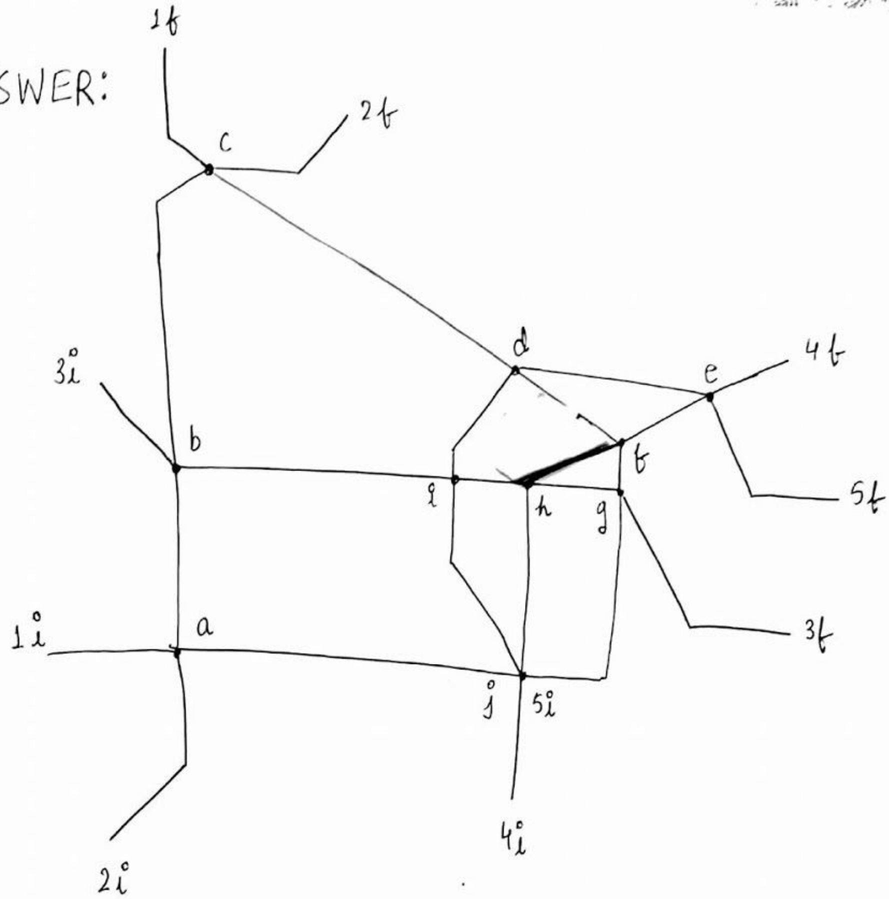
$$\begin{array}{ccccc} 2 & - & 1 & & 2 \\ | & & & & \| \\ 3 & = & 3 & - & 3 \end{array}$$

$$\begin{array}{ccccc} 3 & - & 1 & & 2 \\ \| & & & & \| \\ 3 & - & 2 & - & 3 \end{array}$$

$$\begin{array}{ccccc} 2 & & 1 & & 2 \\ \| & & | & & \| \\ 3 & - & 3 & - & 3 \end{array}$$

Question 12:

ANSWER:



Move 1: 1i → a

Time elapsed - 5 mins
Time taken - 5 mins

Guards will be leaving: 1:(d) 2:(b,b) 3:(i,h) 4:(h,f) 5:(d,d)

Move 2: a → j

Time elapsed - 10 mins

Now, all leave their junctions. The agent doesn't get caught (at j) as the guard leaves as he enters the junction.

Guards will be leaving; 1:(g) 2:(2f,2i) 3:(g,b) 4:(e,J) 5:(5f,5i)

Move 3: $j \to h$ 2 mins ← time taken
$h \to f$ Time elapsed : 12 mins

Now, 2 does not matter anyore. (self-explanatory)

As only 2 more mins have elapsed, the guards will be staying at the following stops (for 30 more seconds)

1 : (J) 3 : (3f , 3i) 4 : (4f , 4i) 5 : (e, i)

Move 4: $f \to e$ 1 min ← time taken
Time elapsed : 13 min

Now the guards are in motion as follows –

1 : (J → a) 2 : (3f → g , 3i → b) 4 : (4f → e, 4i → J)
5 : (e → d , i → d)

At this point, the game becomes very clear.

One final move : $\boxed{e \to 5f}$ ⇒ and game over
(3 mins)

Total time taken : 16 mins

Answer : **16 min**

Question 13:

C) 14, 15

(a) 2, -1, 1

(b) 1,4,1,3,3,4, -1

Question 14:

Hit and trial

Ans: **1**

Question 15:

Crab is more likely to win.

Label a carton with a "b" (respectively, a "c") if Crab (respectively, Ron) reaches that carton more quickly, and also record Crab's (respectively, Ron's) score upon reaching that carton. Label cartons A and L with "xx" since both players reach those cartons simultaneously.
We obtain:

xx b2 b3 b4
c2 c5 b7 b8
c3 c6 c9 xx

Note that there are five b cartons and five c cartons. So the cases in which Alice selects carton A or carton L are equally split between Crab and Ron. Similarly if Alice selects two b cartons then Crab necessarily wins, but these are balanced out by an equal number of cases in which Alice selects two c cartons and C necessarily wins.

The crucial cases occur when Alice selects one b carton and one c carton. Crab wins if the b carton has a lower score than the c carton:

b2 and (c3 or c5 or c6 or c9)
b3 and (c5 or c6 or c9)
b4 and (c5 or c6 or c9)
b7 and c9
b8 and c9

Ron wins if the c carton has a lower score than the b carton:

c2 and (b3 or b4 or b7 or b8)
c3 and (b4 or b7 or b8)

Question 16:

23

This is based on the fact that HCF or GCD of (a,a-b) or (a-b,b) is the same that of (a,b). This Follows from the fact that every mutual factor of a and b are also the factor of a+b and |a-b|.

And so becomes the grid. This will happen at each stage of reach for some (a,b);

Thus lion can only reach those points whose gcd or hcf is (8,10)==2;

Therefore the answer is all the coordinates whose hcf is 2;

{(2,2)}*1

{(2,4) (4,6) (6,8) (8,10) (10,12)

(2,6) (6,10)

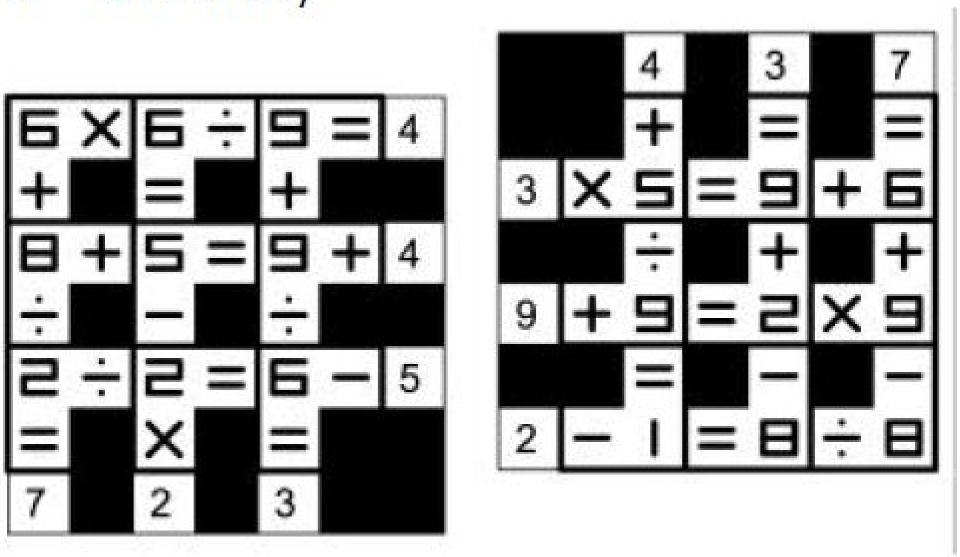
(2,8) (4,10)

(2,10) (2,12)} * 2(As these could be both a,b and b,a)

Ans 11*2 + 1 = **23**

Question 17:

12 - Block Party



A=4, B=5, C=7, D=2, E=3, F=9

Question 18, 19:

abc

You can measure **23 different lengths**. Here's an explanation.
The first trick is realizing that you can record 30 minutes by burning both ends of one rope. Since you know it takes an hour to burn through a rope from one end to the other, once the two burns meet you know each will have burned through 30 minutes of rope (even though they might not meet at the center of the rope thanks to the non-constant burn rates). You also have to consider burning the ends of the ropes at different times. For example, to measure 45 minutes, you can burn both ends of the first rope and one end of the second rope. After 30 minutes have passed, you can burn the other end of the second rope, making 45 minutes.

The calculation gets very tricky as we add ropes. Below are the possible lengths of time (in minutes, not including zero):

One rope: 30 and 60

Two ropes: 30, 45, 60, 90 and 120

Three ropes: 30, 45, 52.5, 60, 67.5, 75, 90, 105, 120, 150 and 180

Four ropes: 30, 45, 52.5, 56.5, 60, 67.5, 71.25, 75, 78.75, 82.5, 86.25, 90, 97.5, 105, 112.5, 120, 127.5, 135, 150, 165, 180, 210 and 240

Some of these time points are difficult to determine. For example, below are the many steps it takes to measure precisely 71.25 minutes with four ropes.
(Let ri represent rope i.)
1. Light both ends of r1, one end of r2, and one end of r3
2. 30 minutes pass (r1 burned through)
3. Light the other end of r2 and one end of r4
4. 15 minutes pass (r2 burned through)
5. Light the other end of r3
6. 7.5 minutes pass (r3 burned through)
7. Light the other end of r4
8. 18.75 minutes pass (r4 burned through)

The total time passed is 71.25 minutes (=30+15+7.5+18.75).

Finally, the following is the general solution for the number of lengths of time, *T*, you can measure with *N* ropes:

T = 3 * 2^(N-1) – 1

Question 20: