

1 Save humanity by choosing the best attack combination

Once again, the whole universe is in danger. Iron Man, Thor, the Hulk and the rest of the Avengers unite to battle their most powerful enemy yet, the evil Thanos. Thanos' plan is to wipe out half of life in the known universe to save it from contamination and destruction. To reach his goal, Thanos has to acquire the six Infinity Stones. However, he has already gained one of the stones (the stone power), from the planet Xandar and is headed to capture the space stone. The Avengers' next mission is to work together and beat Thanos. They know that they cannot fight Thanos alone. While some will go on this mission, others will have to stay on Earth and defend it against Thanos' lieutenants—Ebony Maw, Cull Obsidian, Proxima Midnight, and Corvus Glaive.

Important Information

1. Due to the capacity of the spaceship only eight Avengers are selected to fight Thanos: Dr. Stephen Strange, Iron Man, Thor, Captain America, Black Widow, Spider Man, Mantis, and Star-Lord.
2. The Mantis's role is to immobilize Thanos by controlling his mind. She can only do this for **at most two minutes** before being overpowered by Thanos.
3. The other seven Avengers should find the attack strategy with the greatest impact to defeat Thanos. The best strategy is to use combinations of small attacks based on each Avenger's capabilities.
4. Table 1 shows the impact on Thanos of each attack by the different Avengers and the name of each attack. For example, Captain America has an impact per attack of 13 units on Thanos and his attack is called Unyielding Justice.

| | Dr. Stephen Strange (The Eye of Agamotto) | Iron Man (Repulsor Blasts Supercut) | Thor (Mighty Tornado) | Captain America (Shock Therapy) | Black Widow (Unyielding Justice) | Spider Man (Web Shooting) | Star-Lord (Star punch) |
|-------------------|--|--|--------------------------|------------------------------------|-------------------------------------|------------------------------|---------------------------|
| Impact per attack | 24 | 21 | 30 | 13 | 8 | 18 | 6 |

Table 1: Impact of Avengers' attacks

5. All attacks require energy. Table 2 shows the available energy per Avenger in a **two minute time span** and the energy requirement for each attack by an Avenger. Note that an Avenger can only do as many attacks as allowed by the amount of energy available and cannot do partial attacks. E.g. Iron Man can at most do 9 attacks and can do nothing else with the remaining 10 energy units.

| | Dr. Stephen Strange | Iron Man | Thor | Captain America | Black Widow | Spider Man | Star-Lord |
|--|---------------------|----------|------|-----------------|-------------|------------|-----------|
| Total available energy per avenger | 250 | 200 | 300 | 130 | 90 | 120 | 50 |
| Energy usage per attack for each avenger | 33 | 21 | 35 | 13 | 11 | 18 | 7 |

Table 2: Energy availability and requirement per attack

6. The avengers have **two minutes maximum** to attack Thanos. **They can all attack simultaneously.** As some avengers are slower than others another restriction to consider is time. Table 3 shows the time requirement in seconds for each attack by an avenger.

| | Dr. Stephen Strange | Iron Man | Thor | Captain America | Black Widow | Spider Man | Star-Lord |
|--------------------------------|---------------------|----------|------|-----------------|-------------|------------|-----------|
| Time usage per attack(seconds) | 22 | 20 | 25 | 10 | 19 | 24 | 14 |

Table 3: Time requirement per attack

As Thanos is very powerful, there are some requirements the avengers' attack strategy must satisfy.

1. Spider man has to shoot spider-webs at least five times to help the Mantis controlling Thanos.
2. Thor cannot attack more than six times.
3. Dr. Stephen Strange cannot execute more than twice the number of attacks Iron Man does.
4. The total number of attacks by Captain America, Black Widow, Iron Man, and Star Lord should not be less than the sum of the number of attacks by Thor and Dr. Stephen Strange.

Question:

How many attacks should each avenger execute in the two minute limit to create the biggest impact on Thanos? The **objective** is to do as much damage to Thanos as possible.

Answer

The number of attacks of each type is:

Dr. Stephen Strange _____ Iron Man _____ (1)

Thor _____ Captain America _____ (2)

Black Widow _____ Spider Man _____ (3)

Star-Lord _____ (4)

The total amount of impact in the two minutes will be _____.

Note: Your solution will be penalized if it exceeds the available energy or the available time limits of each avenger or if it violates the requirements.