The Mosh-Pit Computing

Reading this document beyond this section means you agree with the following:

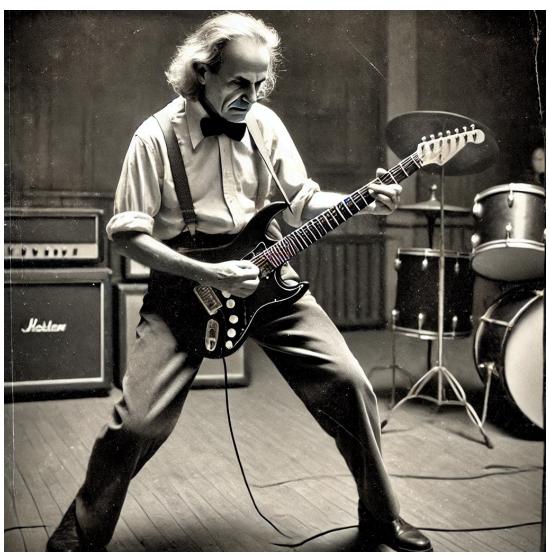
Mosh pit is an intrinsically dangerous activity. Do it at your own risk. IonQ does not endorse mosh pit or any form of violence. This story is simply a joke made by quantum application scientists out of boredom and loneliness!

We know jokes can sometimes offend people, so we ensured the onboarding notebook is self-sufficient for the challenges should you skip this document.

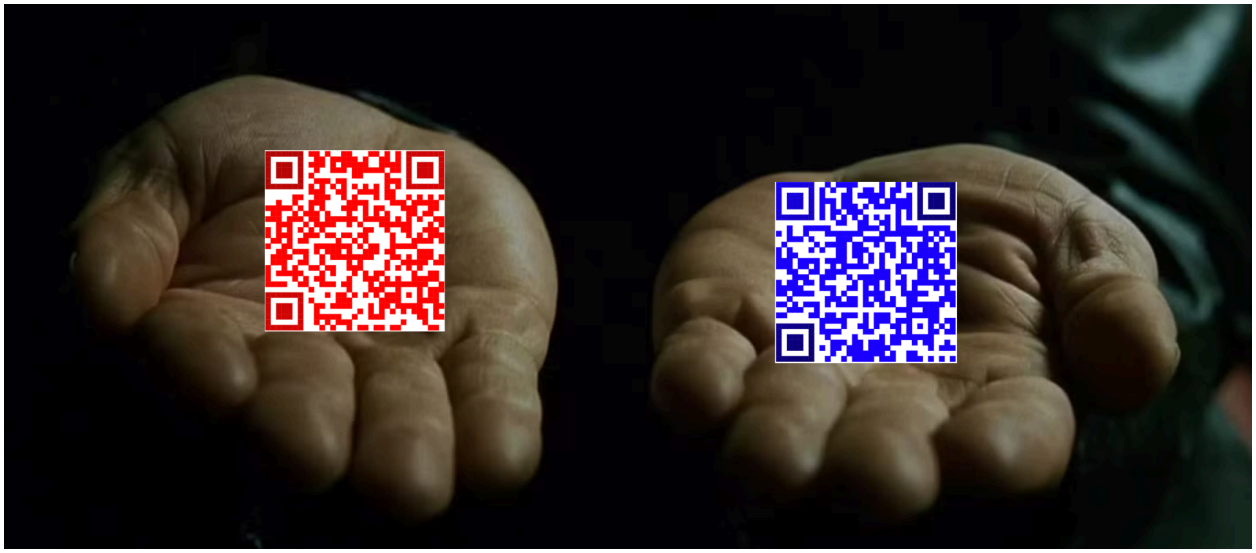
Skip the document and watch this video if the jokes here offend you.

Introduction:

It is impossible to discuss quantum science without mentioning rock music, particularly the genre known as heavy metal. It's no coincidence that the golden age of heavy metal largely coincided with the golden age of modern physics. Old photos reveal that many renowned physicists were also passionate about heavy metal music.



Among all the standard heavy metal practices, the mosh pit has the most significant connection to physics.
If you're not a metal or rock fan and haven't heard of a mosh pit, don't panic! You can prepare yourself by watching one of these two onboarding videos (both will do the trick, I promise):



A mosh pit is not just any random pit—it is a pit filled with the deepest secrets of the universe and quantum physics. Attend any physics conference these days, and you'll learn that the core of modern quantum science lies in the dynamics of highly correlated spin interactions. The mosh pit is, without a doubt, the ultimate embodiment of passion, spin, correlation, and dynamics.

If quantum computers, as Feynman theorized, use natural quantum qubits to simulate quantum science effectively, then the mosh pit, as Ozzy Osbooon suggested, with its spinning individuals entangled by sheer dynamical passion, can effectively simulate correlated quantum spin

dynamics. It's no exaggeration to say that mastering mosh-pit computing could be the first step to excelling in quantum computing.

Here, we present a photo of an early attempt at studying quantum spin dynamics through mosh-pit computing.

Over the years, mosh-pit computing has steadily gained popularity. We have started to see attempts to extend mosh-pit computing to complicated real-world problems. Here are some photos of mosh-pit computing being applied to social policy optimization:

Obviously, in these cases, a mosh-pit advantage is not observed nor theoretically proved.

Hackathon Challenges

Due to the critical importance of the mosh pit, IonQ consistently hosts its annual event at a metal music festival, allowing its R&D team to gain hands-on experience with mosh pit

dynamics. However, organizing a successful mosh pit event requires careful consideration of the several interpersonal relationship issues among the participants. These issues mount up to our three challenges.

Challenge 1:

When organizing a mosh pit involving two groups, it's crucial to include as many participants as possible who already share connections across both sides. This ensures that when the groups collide, the interaction is grounded in love, respect, and care. Conversely, when strangers engage in moshing, the dynamic can quickly become chaotic and unpredictable.

For this challenge, you will be provided with relationship graphs representing the employees at IonQ. In these graphs, nodes represent employees, and edges indicate friendly relationships strong enough to support moshing interactions. Your task is to split each graph into two sets of nodes in a way that maximizes the number of edges spanning across the two sets. This arrangement helps foster a positive and engaging mosh pit experience.

Challenge 2:

To ensure the mosh pit is bursting with passion, we aim to have a roughly equal number of participants on both sides. This balance maximizes the energy and amplifies the shared excitement. If the two groups are too unbalanced, it might as well be called "The Matrix" instead of a mosh pit!

In this challenge, your task is almost identical to the first one, but with an added twist: you need to divide the graph in a way that ensures the two sets of nodes are evenly balanced.

Challenge 3:

For a mosh pit to go smoothly, it's important that people within the same side have some level of connection. If subsets of people on the same side are completely disconnected, problems can arise due to a lack of love, care, and mutual respect—even if they're not directly interacting during the mosh. Consider this example, which highlights the consequences of insufficient social bonds within the same side.

In this challenge, your task is to accomplish everything required in Challenge 2, but with an added constraint: the subgraphs formed by employees within each of the two sets must be connected.

Extra challenge - educate others about your solution:

Share your insights and innovative solutions for this challenge on the iQuHACK 2025-IonQ GitHub discussions page (https://github.com/iQuHACK/2025-IonQ/discussions). Feel free to propose your own challenges, too! Engage with others by upvoting, commenting, and contributing to the conversation. The most impactful contributions may even receive a prize! This challenge should be fun and engaging.

Good luck!

IonQ iQuHack2025 Team