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How does one create a set of sets in Rust? Is it necessary to write an `impl` block for every concrete type satisfying `HashSet<HashSet<_>>?`

Minimal failing example:

```
fn main () {  
    let a: HashSet<u32> = HashSet::new();  
    let c: HashSet<HashSet<u32>> = HashSet::new();  
    c.insert(a);  
}
```

Error:

```
"insert" method cannot be called on `std::collections::HashSet<std::collections::HashSet<u32>>` due to unsatisfied trait bound  
HashSet doesn't satisfy `std::collections::HashSet<u32>: Hash`
```

Is it possible to override the fact that `HashSet` is unhashable? I'd like to use a `HashSet` and need my contents to be unique by actual (memory) equality; I don't need to unique by contents.

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asked Mar 21, 2022 at 18:01

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`HashSet` is not hashable since its iteration order is unpredictable. You can use [BTreeSet](#) instead.

apilat – [apilat](#)

2022-03-21 18:14:54 +00:00

Commented Mar 21, 2022 at 18:14

Does this answer your question? [Why is BTreeMap hashable, and not HashMap?](#)

Aiden4 – [Aiden4](#)

2022-03-21 18:26:34 +00:00

Commented Mar 21, 2022 at 18:26

Yes. Makes perfect sense. It is possible to "override" the behavior: make two different sets unequal even when they have the same contents?

Test – [Test](#)

2022-03-21 18:35:19 +00:00

Commented Mar 21, 2022 at 18:35

I'd like to have a set of sets and want them to be unique by "actual" (memory) equality, not by contents.

Test – [Test](#)

2022-03-21 18:41:27 +00:00

Commented Mar 21, 2022 at 18:41

2

@Test Rust values are not automatically heap-allocated, so they don't have a stable address you could use as "identity", as is the case in, say, Python.

user4815162342 – [user4815162342](#)

2022-03-21 18:42:11 +00:00

Commented Mar 21, 2022 at 18:42

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2 Answers

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I'd like to have a set of sets and want them to be unique by "actual" (memory) equality, not by contents.

To do so you first need to box the hashset so that it has a stable memory address. For example:

```
struct Set<T>(Box<HashSet<T>>);
```

To make your Set hashable, you'll need to implement Hash and Eq:

```
impl<T> Set<T> {
    fn as_addr(&self) -> usize {
        // as_ref() gives the reference to the heap-allocated contents
        // inside the Box, which is stable; convert that reference to a
        // pointer and then to usize, and use it for hashing and equality.
        self.0.as_ref() as *const _ as usize
    }
}

impl<T> Hash for Set<T> {
    fn hash<H: Hasher>(&self, state: &mut H) {
        self.as_addr().hash(state);
    }
}

impl<T> Eq for Set<T> {}

impl<T> PartialEq for Set<T> {
    fn eq(&self, other: &Self) -> bool {
        self.as_addr() == other.as_addr()
    }
}
```

Finally, you'll need to add some set-like methods and a constructor to make it usable:

```
impl<T: Hash + Eq> Set<T> {
    pub fn new() -> Self {
        Set(Box::new(HashSet::new()))
    }

    pub fn insert(&mut self, value: T) {
        self.0.insert(value);
    }

    pub fn contains(&mut self, value: &T) -> bool {
        self.0.contains(value)
    }
}
```

Now your code will work, with the additional use of Rc so that you have the original Set available for lookup after you insert it:

```
fn main() {
    let mut a: Set<u32> = Set::new();
    a.insert(1);
    let a = Rc::new(a);
    let mut c: HashSet<_> = HashSet::new();
    c.insert(Rc::clone(&a));
    assert!(c.contains(&a));
}
```

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[edited Mar 21, 2022 at 19:11](#)

[answered Mar 21, 2022 at 18:57](#)

[user4815162342](#)

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4 Comments

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Test

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This is very nice, thank you. Does it not require a pin? I broke out the specifically question about Hash/Eq, but now I'm a bit confused.

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Could one create a struct with the hashset as one property and the Box as a separate property? The hashset could be used without a lookup, and the box serve only for equality.

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user4815162342

[user4815162342 Over a year ago](#)

@Test Re 1st comment: It doesn't require a pin, it's actually the box that makes an object stable in memory. A pin is only needed when you must expose a mutable reference to the box and need to prevent someone from replacing it with another box using `std::mem::replace()` or equivalent. That cannot happen here because the box is private to the object, and it's ok if replacing the whole object changes its identity.

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user4815162342

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@Test Re 2nd comment: yes, but in that case you don't need to box, an ordinary counter will suffice. That approach is covered in [my answer to your other question](#).

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As pointed out helpfully in the comments, it's not possible to hash sets because they have no fixed address. An effective, if inelegant, solution, is to wrap them in a specialized struct:

```
struct HashableHashSet<T> {  
    hash: ...  
    hashset: HashSet<T>  
}
```

And then hash the struct by memory equality.

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[edited Mar 21, 2022 at 18:50](#)

answered Mar 21, 2022 at 18:45

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user4815162342

[user4815162342 Over a year ago](#)

As also pointed out in the comments (and in the other answer), the `hashset` field needs to be something like `Box<HashSet<T>>` to make its address stable as `HashSet` gets moved.

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