

# fn make\_privacy\_filter

Michael Shoemate

This proof resides in “**contrib**” because it has not completed the vetting process.

Proves soundness of fn make\_privacy\_filter.

## 1 Hoare Triple

### Precondition

#### Compiler-verified

- Argument odometer of type Odometer<DI, MI, MO, Q, A>.
- Argument d\_in of type MI\_Distance, the associated distance type of MI.
- Argument d\_out of type MO\_Distance, the associated distance type of MO.
- Generic DI implements **Domain**.
- Generic MI implements **Metric**.
- Generic MO implements **Measure**.
- MI\_Distance implements **ProductOrd**.
- MO\_Distance implements **ProductOrd**.
- (DI, MI) implements **MetricSpace**.

#### User-verified

None

### Pseudocode

```
1 def make_privacy_filter(  
2     odometer: Odometer[DI, MI, MO, Q, A],  
3     d_in: MI_Distance,  
4     d_out: MO_Distance,  
5 ) -> Measurement[DI, MI, MO, OdometerQueryable[MI, MO, Q, A]]:  
6     odo_function = odometer.function  
7     continuation_rule = new_continuation_rule( #  
8         d_in, d_out, Q, A, MI_Distance, MO_Distance  
9     )  
10  
11     def function(arg: DI_Carrier) -> OdometerQueryable[MI, MO, Q, A]:  
12         return wrap(continuation_rule, lambda: odo_function.eval(arg)) #  
13
```

```

14 def privacy_map(d_in_p: MI_Distance) -> MO_Distance:
15     if d_in_p.total_gt(d_in):
16         raise "input distance must not be greater than d_in"
17
18     return d_out
19
20 return Measurement.new(
21     odometer.input_domain,
22     odometer.input_metric,
23     odometer.output_measure,
24     Function.new_interactive(function),
25     PrivacyMap.new_fallible(privacy_map),
26 )

```

## Postcondition

For every setting of the input parameters (odometer, d\_out, DI, MI, MO, Q, A) to `make_privacy_filter` such that the given preconditions hold, `make_privacy_filter` raises an error (at compile time or run time) or returns a valid odometer. A valid odometer has the following properties:

1. (Data-independent runtime errors). For every pair of members  $x$  and  $x'$  in `input_domain`, `invoke(x)` and `invoke(x')` either both return the same error or neither return an error.
2. (Valid odometer queryable). For every member  $x$  in `input_domain`, where `function(x)` does not raise an error, `function(x)` returns a valid odometer queryable.

*Proof of data-independent errors.* `Function.eval` on line 12 has data-independent exceptions, because the function is from `odometer`, which is a valid odometer. Since this is the only location where an exception can be raised, the data-independent errors property holds. □

*Proof of privacy guarantee.* By the definition of a valid odometer queryable, the output of `make_privacy_filter` upholds the privacy guarantee. □