General Pattern

1. **Original Problem Pattern**

```
Find s: N² → N where Ws(x,y) has some property P(x,y)
```

2. **Solution Strategy**

- Define a helper function g that takes additional arguments
- Use smn theorem to transform g into the desired s

Steps to Determine Domains

1. **For the Helper Function g**

```
If trying to control |Ws(x,y)|:
- Input: typically needs (x, y, z) where z is the "counter" or "tester"
- Output: usually N (typically {0,1} or {0} to control the domain)

Example from the image:
g: N³ → N
g(x,y,z) = { 0, if z < x*y
           { 1, otherwise
```

2. **For the Final Function s**

```
- Domain: Always matches what you need to "fix" (typically N² for these
exercises)
- Codomain: Always N (as s produces program indices)

Example from the image:
s: N² → N
where |Ws(x,y)| = x*y
```

Key Points to Remember

1. The helper function g typically needs:

- All parameters from s (x,y in these examples)
- An extra parameter z for testing/counting
- Boolean output (0/1) to control domain size

2. The final function s always:
   - Takes the parameters you want to "fix"
   - Returns a program index (so codomain is N)
   - Controls Ws(x,y) through the helper function
3. Look at what you're trying to control:
   - If controlling size of Ws(x,y), you need a way to count elements
   - If controlling content of Ws(x,y), you need a way to test membership

This structured approach helps ensure you get the domains right every time.