

Experiment ‘p6_2_d_replace_with_larger_neighbor’ Results

December 18, 2025

Experiment outcome: SUCCESS

Bad responses: 0

Responses containing assume : 0

Resolution attempts: 6

Hard fails (resolution): 5

Soft fails (resolution): 0

Verification attempts: 1

Problem Specification

Problem name: p6_2_d_replace_with_larger_neighbor

Natural language statement: Write a method to replace each element of an array, except the first and last, by the larger of its two neighbors.

Method signature: p6_2_d_replace_with_larger_neighbor(arr: seq<int>) returns (result: seq<int>)

Ensures

- `|result| == |arr|`
- `result[0] == arr[0]`
- `result[|arr| - 1] == arr[|arr| - 1]`
- `forall i :: 1 <= i < |arr| - 1 ==> result[i] == if arr[i - 1] >= arr[i + 1] then arr[i - 1] else arr[i + 1]`

Requires

- `|arr| >= 3`

GenAI interactions

Below you will find all interactions between the ‘user’ (program) and the ‘assistant’ (OpenAI).

Program → GenAI

You are given the following task to perform in Dafny:

Write a method to replace each element of an array, except the first and last, by the
→ larger of its two neighbors.

The signature should be:

method p6_2_d_replace_with_larger_neighbor(arr: seq<int>) returns (result: seq<int>)

The method should respect the following contract:

requires |arr| >= 3, ensures |result| == |arr|, ensures result[0] == arr[0], ensures
→ result[|arr| - 1] == arr[|arr| - 1], ensures forall i :: 1 <= i < |arr| - 1 ==>
→ result[i] == if arr[i - 1] >= arr[i + 1] then arr[i - 1] else arr[i + 1]

Produce and show only the Dafny body of this method, including the curly braces that
→ surround it. Do not show the signature nor contract. You must not use 'assume'
→ anywhere in your code.

GenAI → Program

System fingerprint:

ID: chatcmpl-Co56MKd4Tv7Pbgjho8YXik8WkAtJN

Model: gpt-5.1-chat-latest

Created at: 1766052046

Finish reason: stop

Usage: 456 tokens in, and 285 tokens out

```
{  
  var mid := seq i | 1 <= i < |arr| - 1 :: if arr[i - 1] >= arr[i + 1] then arr[i - 1]  
    → else arr[i + 1];  
  result := arr[0..1] + mid + arr[|arr| - 1..];  
}
```

Program → GenAI

When using dafny resolve, the below error is emitted and resolve fails:

```
problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(8,17): Error: openparen  
  → expected  
|  
8 | var mid := seq i | 1 <= i < |arr| - 1 :: if arr[i - 1] >= arr[i + 1] then arr[i - 1]  
  → else arr[i + 1];  
| ^
```

```
problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(8,40): Error: comma expected
|
8 | var mid := seq i | 1 <= i < |arr| - 1 :: if arr[i - 1] >= arr[i + 1] then arr[i - 1]
  ↪ else arr[i + 1];
  | ^

2 parse errors detected in program.dfy

Correct the error by altering only the method body. Produce and show only the Dafny body,
  ↪ including the curly braces that surround it. Do not show the signature nor
  ↪ contract. You must not use 'assume' anywhere in your code.
```

GenAI → Program

System fingerprint:

ID: chatcmpl-Co56QzzRQ1FGoQvREuWvoQa5WckRE

Model: gpt-5.1-chat-latest

Created at: 1766052050

Finish reason: stop

Usage: 810 tokens in, and 159 tokens out

```
{
  var mid := seq(i | 1 <= i && i < |arr| - 1 :: if arr[i - 1] >= arr[i + 1] then arr[i -
    ↪ 1] else arr[i + 1]);
  result := arr[0..1] + mid + arr[|arr| - 1..];
}
```

Program → GenAI

When using dafny resolve, the below error is emitted and resolve fails:

```
problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(8,45): Error: comma expected
|
8 | var mid := seq(i | 1 <= i && i < |arr| - 1 :: if arr[i - 1] >= arr[i + 1] then arr[i
  ↪ - 1] else arr[i + 1]);
  | ^

1 parse errors detected in program.dfy

Correct the error by altering only the method body. Produce and show only the Dafny body,
  ↪ including the curly braces that surround it. Do not show the signature nor
  ↪ contract. You must not use 'assume' anywhere in your code.
```

GenAI → Program

System fingerprint:

ID: chatcmpl-Co56TVlWvMrb2i7WyKFxxpVPLBTgr

Model: gpt-5.1-chat-latest

Created at: 1766052053

Finish reason: stop

Usage: 981 tokens in, and 161 tokens out

```
{
  var mid := seq(i | 1 <= i && i < |arr| - 1,
    if arr[i - 1] >= arr[i + 1] then arr[i - 1] else arr[i + 1]);
  result := arr[0..1] + mid + arr[|arr| - 1..];
}
```

Program → GenAI

When using dafny resolve, the below error is emitted and resolve fails:

```
problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(8,17): Error: unresolved
  ↪ identifier: i
  |
8 | var mid := seq(i | 1 <= i && i < |arr| - 1,
  | ^

problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(8,26): Error: unresolved
  ↪ identifier: i
  |
8 | var mid := seq(i | 1 <= i && i < |arr| - 1,
  | ^

problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(8,31): Error: unresolved
  ↪ identifier: i
  |
8 | var mid := seq(i | 1 <= i && i < |arr| - 1,
  | ^

problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(9,24): Error: unresolved
  ↪ identifier: i
  |
9 | if arr[i - 1] >= arr[i + 1] then arr[i - 1] else arr[i + 1]);
  | ^

problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(9,38): Error: unresolved
  ↪ identifier: i
  |
9 | if arr[i - 1] >= arr[i + 1] then arr[i - 1] else arr[i + 1]);
  | ^

problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(9,54): Error: unresolved
  ↪ identifier: i
  |
9 | if arr[i - 1] >= arr[i + 1] then arr[i - 1] else arr[i + 1]);
  | ^

problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(9,70): Error: unresolved
  ↪ identifier: i
  |
9 | if arr[i - 1] >= arr[i + 1] then arr[i - 1] else arr[i + 1]);
```

```

| ~
problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(8,28): Error: sequence
  ↪ construction must use an integer-based expression for the sequence size (got bool)
|
8 | var mid := seq(i | 1 <= i && i < |arr| - 1,
| ^^
problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(9,17): Error: sequence-
  ↪ construction initializer expression expected to have type 'nat ~> ?' (instead got
  ↪ 'int')
|
9 | if arr[i - 1] >= arr[i + 1] then arr[i - 1] else arr[i + 1]];
| ^^
problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(8,19): Error: first argument
  ↪ to | must be of a bitvector type (instead got int)
|
8 | var mid := seq(i | 1 <= i && i < |arr| - 1,
| ^
problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(8,19): Error: second
  ↪ argument to | must be of a bitvector type (instead got int)
|
8 | var mid := seq(i | 1 <= i && i < |arr| - 1,
| ^
11 resolution/type errors detected in program.dfy

Correct the error by altering only the method body. Produce and show only the Dafny body,
  ↪ including the curly braces that surround it. Do not show the signature nor
  ↪ contract. You must not use 'assume' anywhere in your code.

```

GenAI → Program

System fingerprint:

ID: chatcmpl-Co56X8hqR7w4vjgTPWccafVfWK3Dg

Model: gpt-5.1-chat-latest

Created at: 1766052057

Finish reason: stop

Usage: 2498 tokens in, and 214 tokens out

```

{
  var mid := seq(j | 0 <= j < |arr| - 2 :: if arr[j] >= arr[j + 2] then arr[j] else arr[j]
    ↪ + 2]);
  result := [arr[0]] + mid + [arr[|arr| - 1]];
}

```

Program → GenAI

When using dafny resolve, the below error is emitted and resolve fails:

```

problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(8,40): Error: comma expected
|
8 | var mid := seq(j | 0 <= j < |arr| - 2 :: if arr[j] >= arr[j + 2] then arr[j] else arr
  ↪ [j + 2]);
  | ^

```

1 parse errors detected in program.dfy

Correct the error by altering only the method body. Produce and show only the Dafny body,
 ↪ including the curly braces that surround it. Do not show the signature nor
 ↪ contract. You must not use 'assume' anywhere in your code.

GenAI → Program

System fingerprint:

ID: chatcmpl-Co56aU3GgI8ssAlxL1YHaOHrBcVvi

Model: gpt-5.1-chat-latest

Created at: 1766052060

Finish reason: stop

Usage: 2092 tokens in, and 416 tokens out

```

{
  var mid := seq(i | (1 <= i && i < |arr| - 1) :: if arr[i - 1] >= arr[i + 1] then arr[i
    ↪ - 1] else arr[i + 1]);
  result := arr[0..1] + mid + arr[|arr| - 1..];
}

```

Program → GenAI

When using dafny resolve, the below error is emitted and resolve fails:

```

problem_data/p6_2_d_replace_with_larger_neighbor/program.dfy(8,47): Error: comma expected
|
8 | var mid := seq(i | (1 <= i && i < |arr| - 1) :: if arr[i - 1] >= arr[i + 1] then arr[
  ↪ i - 1] else arr[i + 1]);
  | ^

```

1 parse errors detected in program.dfy

Correct the error by altering only the method body. Produce and show only the Dafny body,
 ↪ including the curly braces that surround it. Do not show the signature nor
 ↪ contract. You must not use 'assume' anywhere in your code.

GenAI → Program

System fingerprint:

ID: chatcmpl-Co56g3xLJ3W40V4a6YyoyZCPHRGw7

Model: gpt-5.1-chat-latest

Created at: 1766052066

Finish reason: stop

Usage: 2354 tokens in, and 461 tokens out

```
{
  var s := [arr[0]];
  var i := 1;
  while i < |arr| - 1
    invariant 1 <= i <= |arr| - 1
    invariant |s| == i
    invariant s[0] == arr[0]
    invariant forall k :: 1 <= k < i ==> s[k] == (if arr[k - 1] >= arr[k + 1] then arr[k -
      ↪ 1] else arr[k + 1])
  {
    s := s + [if arr[i - 1] >= arr[i + 1] then arr[i - 1] else arr[i + 1]];
    i := i + 1;
  }
  s := s + [arr[|arr| - 1]];
  result := s;
}
```

Final Program

```
method p6_2_d_replace_with_larger_neighbor(arr: seq<int>) returns (result: seq<int>)
  requires |arr| >= 3
  ensures |result| == |arr|
  ensures result[0] == arr[0]
  ensures result[|arr| - 1] == arr[|arr| - 1]
  ensures forall i :: 1 <= i < |arr| - 1 ==> result[i] == if arr[i - 1] >= arr[i +
    ↪ 1] then arr[i - 1] else arr[i + 1]
{
  var s := [arr[0]];
  var i := 1;
  while i < |arr| - 1
    invariant 1 <= i <= |arr| - 1
    invariant |s| == i
    invariant s[0] == arr[0]
    invariant forall k :: 1 <= k < i ==> s[k] == (if arr[k - 1] >= arr[k + 1] then arr[k -
      ↪ 1] else arr[k + 1])
  {
    s := s + [if arr[i - 1] >= arr[i + 1] then arr[i - 1] else arr[i + 1]];
    i := i + 1;
  }
  s := s + [arr[|arr| - 1]];
  result := s;
}
```

Total Token Usage

Input tokens: 9191

Output tokens: 1696

Reasoning tokens: 1024
Sum of ‘total tokens’: 10887

Experiment Timings

Overall Experiment started at 1766052048133, ended at 1766052074567, lasting 26434ms (26.43 seconds)
Iteration #4 started at 1766052059316, ended at 1766052062445, lasting 3129ms (3.13 seconds)
Iteration #5 started at 1766052062445, ended at 1766052067902, lasting 5457ms (5.46 seconds)
Iteration #6 started at 1766052067902, ended at 1766052074567, lasting 6665ms (6.67 seconds)
Iteration #1 started at 1766052048133, ended at 1766052052752, lasting 4619ms (4.62 seconds)
Iteration #2 started at 1766052052752, ended at 1766052055619, lasting 2867ms (2.87 seconds)
Iteration #3 started at 1766052055619, ended at 1766052059316, lasting 3697ms (3.70 seconds)