Problem 1:

TLA+ found no bugs in the original algorithm for Natural numbers 1-5

Problem 2:

Error-Trace

Name	Value
<Initial predicate>	State (num = 1)
count	0
n	1
pc	"Lbl_1"
sum	0
<Action line 29, col 10 to line 36,	State (num = 2)
count	1
n	1
pc	"Lbl_1"
sum	0
<Action line 29, col 10 to line 36,	State (num = 3)
count	1
n	1
pc	"Done"
sum	0

The issue here is that with the value of n = 1, sum should end up as 1, but instead it is 0. This is because in the conditional of the algorithm, it checks if the variable ‘i’ is less than ‘n’ when it should be a less than or equal comparison.

Problem 3:

Error-Trace

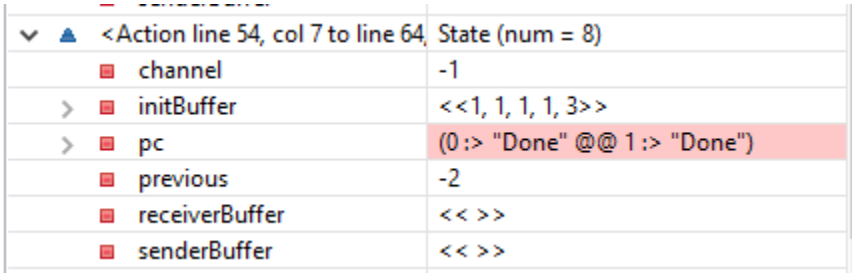
Name	Value
<Initial predicate>	State (num = 1)
data	<<1, 1, 3, 1, 2>>
high	5
key	2
low	0
middle	0
pc	"Lbl_1"
ret	FALSE
<Action line 39, col 10 to line 57,	State (num = 2)
data	<<1, 1, 3, 1, 2>>
high	2
key	2
low	0
middle	3
pc	"Lbl_1"
ret	FALSE
<Action line 39, col 10 to line 57,	State (num = 3)
data	<<1, 1, 3, 1, 2>>
high	2
key	2
low	3
middle	2
pc	"Lbl_1"
ret	FALSE
<Action line 39, col 10 to line 57,	State (num = 4)
data	<<1, 1, 3, 1, 2>>
high	2
key	2
low	3
middle	2
pc	"Done"
ret	FALSE

The issue with this one is that the algorithm sees the 3 in the middle and continues its search down, but the original array is not already sorted, so this algorithm will not always work.

Problem 4:

TLA+ found no errors for Integers in 1..5

Problem 5:



The issue that happens it that the receiver thread dumps all of its stuff before the sender is even able to read anything

This was fixed by adding some busy waiting and a Boolean that says who is allowed to access the channel