# The Use Case

The lesson provides the implementation of a particular use case of std::variant and std::optional

Consider a function that takes the current mouse selection for a game. The function scans the selected range and computes several outputs:

- the number of animating objects
- if there are any civil units in the selection
- if there are any combat units in the selection

The existing code looks like this:

```
class ObjSelection
{
public:
  bool IsValid() const { return true; }
  // more code...
};

bool CheckSelectionVer1(const ObjSelection &objList, bool *pOutAnyCivilUnits, bool *pOutAnyCo
{
    if (!objList.IsValid())
        return false;

    // local variables:
    int numCivilUnits = 0;
    int numCombat = 0;
    int numAnimating = 0;

    // scan...

    // set values:
    if (pOutAnyCivilUnits)
        *pOutAnyCivilUnits = numCivilUnits > 0;

    if (pOutAnyCombatUnits)
        *pOutAnyCombatUnits = numCombat > 0;

    if (pOutNumAnimating)
        *pOutNumAnimating = numAnimating;

    return true;
}
```

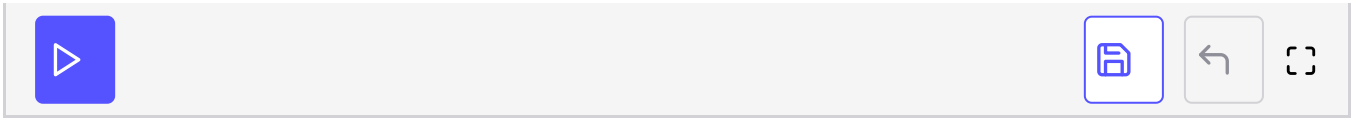
As you can see above, the function uses a lot of output parameters (in the form of raw pointers), and it returns true/false to indicate success (for example the input selection might be invalid). The implementation of the function is not relevant now, but here's an example code that calls this function:

```
int main(){

  ObjSelection sel;

  bool anyCivilUnits { false };
  bool anyCombatUnits { false };
  int numAnimating { 0 };

  if (CheckSelectionVer1(sel, &anyCivilUnits, &anyCombatUnits, &numAnimating))
  {
    std::cout << "ok...\n";
  }
}
```



How can we improve the function?

There might be several things:

- Look at the caller's code: we have to create all the variables that will hold the outputs. It definitely generates code duplication if you call the function in many places.
- Output parameters: Core guidelines suggests not to use them.
  - F.20: For "out" output values, prefer return values to output parameters
- If you have raw pointers you have to check if they are valid. You might get away with the checks if you use references for the output parameters.
- What about extending the function? What if you need to add another output param?

Anything else?
How would you refactor this?

Motivated by Core Guidelines and new C++17 features, here's the plan for how we can improve this code:

1. Refactor output parameters into a tuple that will be returned.

2. Refactor tuple into a separate struct and reduce the tuple to a pair.

3. Use `std::optional` to express if the value was computed or not.
4. Use `std::variant` to convey not only the optional result but also the full error information.

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That pretty much sums up the Use Case. By now you have observed ‘tuples’. Let’s see how the Tuple Version works in the next lesson.