

Chapter 1, exercise 2

Problems

A: Write a procedure, called ADDXY, that takes as input two scalars, x and y , and produces $x+y$ as output. Similarly write a procedure MXY that takes x and y and produces x/y , and a procedure DXY that takes x and y and produces x/y .

B: Next write a program which reads two scalars, x and y , applies ADDXY (MXY, DXY), x and y , and prints the answers in a readable fashion. For example, the printout should consist of statements like ``THE SUM OF---AND---IS---," ``THE PRODUCT OF --- ...,`` and so on.

Solutions in Mathematica

Part A: Simple function definition

Mathematica has many ways to define procedures. We first display the simple way to define a function.

Define the ADDXY function which takes two arguments and computes their sum.

```
In[30]:= ADDXY[x_, y_] := x + y
```

The `:=` symbol says that the LHS will always be interpreted as the RHS.

Define the MXY function which takes two arguments and computes their product.

```
In[31]:= MXY[x_, y_] := x y
```

Define the DXY function which takes two arguments and computes their ratio.

```
In[32]:= DXY[x_, y_] := x / y
```

Check the function with examples.

```
In[33]:= {ADDXY[2, 3], MXY[2, 3], DXY[2, 3], DXY[2., 3]}
```

```
Out[33]= {5, 6,  $\frac{2}{3}$ , 0.666667}
```

Part B: Module definition

The task here is to create a function (or procedure, or ...) which will take as arguments another function and its arguments. This ability is a key feature of modern languages.

We use the Module construction to define a function which outputs a message. Module in Mathematica is used to create a procedure. It is more flexible than the simple function definition in that it can use

arbitrarily complex code.

Also, any text inside of (** ... **) is a comment. I strongly encourage comments inside code. Good code must have enough comments so that others can understand what the code is doing. When writing code you should ask “Will I understand this code if the next time I (actually, my future self) see it is next year?” You should also ask “Can someone else who knows the language I am using understand my code?”

I am trying to write Mathematica code that readers can understand even if they do not know Mathematica. This is a much higher standard. Please contact me if you have questions.

We first need to clear the earlier definitions.

```
In[34]:= Clear[ADDXY, MXY, DXY]
```

Define ADDXY.

```
In[35]:= ADDXY[x_, y_] :=
Module[
  (* List the variables local to the Module. In this case,
  the only local variable is sum. *)
  {sum},
  (* Add the two inputs *)
  sum = x + y;
  (* Print the result along with a description *)
  Print["The sum of x and y is ", sum]]
```

```
In[36]:= ADDXY[2, 3]
```

The sum of x and y is 5

We repeat this for multiplication and division.

```
In[37]:= MXY[x_, y_] :=
Module[
  {product},
  product = x * y;
  Print["The product of x and y is ", product]]
```

```
In[38]:= MXY[2, 3]
```

The product of x and y is 6

```
In[39]:= DXY[x_, y_] :=
Module[
  {ratio},
  ratio = x / y;
  Print["x divided by y is ", ratio]]
```

Our first division example is applied to two integers, which are infinite precision.

In[40]:= **DXY[2, 3]**

x divided by y is $\frac{2}{3}$

The answer is the fraction 2/3. We repeat this by applying DXY to real numbers 2. and 3. where now the decimal point indicates that we are using finite precision arithmetic.

In[41]:= **DXY[2., 3.]**

x divided by y is 0.666667