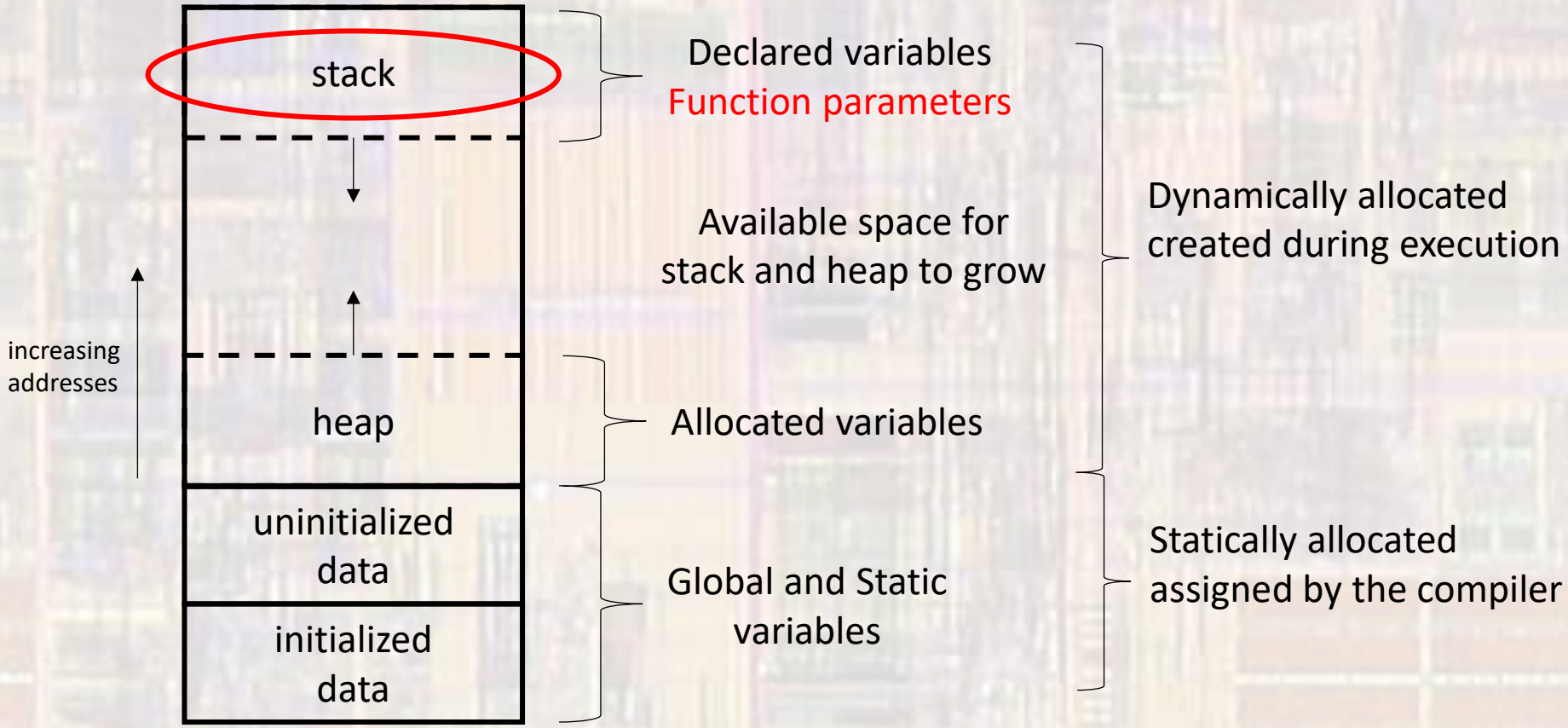
Functions and Data Memory

Last updated 5/13/25

These slides introduce C functions in Data Memory

Functions and Data Memory

- Data Memory Storage
  - Typical structure – but variations exist



Functions and Data Memory

- Process when a function is called

1. A stack frame is created to store the function elements on the stack
   - A stack pointer is created to access the stack (similar to a program counter)
2. The Program Counter (memory location for the Next instruction to be executed) is stored on the stack
3. Memory locations are allocated on the stack for any formal parameters
4. The formal parameter memory spaces are filled with the actual parameter values passed to the function
5. Space is allocated on the stack for any variables that are local to the function
6. The function executes (see notes on Functions in Program Memory)
7. The return value is stored in a special register
8. The local and formal variable memory locations are abandoned, and the stack pointer is updated
9. The Program Counter is reloaded with memory location stored on the stack in step 1 – continuing the program flow

Functions and Data Memory

- Function Example - stack

```
float average(float val1, float val2);
…

int main(void){
  float ave;
  float try1;
  float try2;

t0 →
  // enter try1, try2 … 9, 3
t1 →
  …
  ave = average(try1, try2);
t5 →
  …
  return 0;
}

float average(float val1, float val2){
t2 →
  float tmp;
t3 →
  tmp = (val1 + val2)/2;
t4 →
  return tmp;
}
```

Data Memory - Stack

	t0	t1		t2	t3	t4	t5
ave	?	?		?	?	?	6
try1	?	9		9	9	9	9
try2	?	3		3	3	3	3
	?	?	return addr	0x1000	0x1000	0x1000	0x1000
	?	?	val1	9	9	9	9
	?	?	val2	3	3	3	3
	?	?	tmp	?	6	6	6
result reg				?	?	6	6

Many variations to this process exist

Functions and Data Memory

- Function Example - stack

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int main(void){
  float ave;
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t0 →
  // enter try1, try2 (9, 3)
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float average(float val1, float val2){
t2 →
  float tmp;
t3 →
  tmp = (val1 + val2)/2;
t4 →
  return tmp;
}
```

Data Memory - Stack

	t0	t1		t2	t3	t4	t5
	?	?	tmp	?	6	6	6
	?	?	val2	3	3	3	3
	?	?	val1	9	9	9	9
	?	?	return addr	0x1000	0x1000	0x1000	0x1000
try2	?	3		3	3	3	3
try1	?	9		9	9	9	9
ave	?	?		?	?	?	6
result reg				?	?	6	6

Many variations to this process exist