

Fortran pointers

Victor Eijkhout and Carrie Arnold and Charlie Dey

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Pointers are aliases

- Pointer points at an object
- Access object through pointer
- You can change what object the pointer points at.

`real, pointer :: point_at_real`

Setting the pointer

- You have to declare that a variable is pointable:
`real,target :: x`
- Set the pointer with => notation:
`point_at_real => x`
- Now using `point_at_real` is the same as using `x`.

Pointer example

```
real,target :: x,y  
real,pointer :: that_real
```

```
x = 1.2  
y = 2.4  
that_real => x  
print *,that_real  
that_real => y  
print *,that_real  
y = x  
print *,that_real
```

1. The pointer points at x, so the value of x is printed.
2. The pointer is set to point at y, so its value is printed.
3. The value of y is changed, and since the pointer still points at y, this changed value is printed.

Assign pointer from other pointer

```
real,pointer :: point_at_real,also_point  
point_at_real => x  
also_point => point_at_real
```

Now you have two pointers that point at x.

Very important to use the =>, otherwise strange memory errors

Exercise 1

Write a routine that accepts an array and a pointer, and on return has that pointer pointing at the largest array element.

Linked list

- Linear data structure
- more flexible for insertion / deletion
- ... but slower in access

Linked list datatypes

- Node: value field, and pointer to next node.
- List: pointer to head node.

```
type node
    integer :: value
    type(node),pointer :: next
end type node
```

```
type list
    type(node),pointer :: head
end type list
```

```
type(list) :: the_list
nullify(the_list%head)
```


List initialization

First element becomes the list head:

```
allocate(new_node)
new_node%value = value
nullify(new_node%next)
the_list%head => new_node
```

Attaching a node

Keep the list sorted: new largest element attached at the end.

```
allocate(new_node)
new_node%value = value
nullify(new_node%next)
current%next => new_node
```

Inserting 1

Find the insertion point:

```
current => the_list%head ; nullify(previous)
do while ( current%value<value &
    .and. associated(current%next) )
    previous => current
    current => current%next
end do
```

Inserting 2

The actual insertion requires rerouting some pointers:

```
allocate(new_node)
new_node%value = value
new_node%next => current
previous%next => new_node
```