Input/output in Fortran

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Formatted and unformatted I/O

- Formatted: ascii output. This is good for reporting, but not for numeric data storage.
- Unformatted: binary output. Great for further processing of output data.
- Beware: binary data is machine-dependent. Use *hdf5* for portable binary.

I/O commands

- `Print` simple output to terminal
- `Write` output to terminal or file ('unit')
- `Read` input from terminal or file
- `Open`, `Close` for files and streams
- `Format` format specification that can be used in multiple statements.

Simple print

All on one line:

```
print *,"The result is",result
print *,item1,item2,item3
```

Implicit do loops

Parametrized printing with an *implicit do loop*:

```
print *,( i*i,i=1,n)
```

All values will be printed on the same line.

Array printing

- `print *,A` prints whole array, column-major
- Implicit do loops:

  ```
  print *,( A(i,i),i=1,n)
  ```

  Can also be nested.

Formats

- Fine control of input/output.
- Direct use in print statement:

```
print '(a6,3f5.3)',"Result",x,y,z
print '("Result:",3f5.3)',x,y,z
```

- Format statement:

```
  print 10,"result:",x,y,z
10 format('(a6,3f5.3)')
```

Format specifiers

- '`a`*n*' specifies a string of *n* characters. If the actual string is longer, it is truncated in the output.
- '`i`*n*' specifies an integer of up to *n* digits. If the actual number takes more digits, it is rendered with asterisks.
- '`f`*m*.*n*' specifies a fixed point representation of a real number, with *m* total positions (including the decimal point) and *n* digits in the fractional part.
- '`e`*m*.*n*' Exponent representation.
- Strings can go into the format:

  ```
  print '("Result:",3f5.3)',x,y,z
  ```

- '`x`' for a space, '`/`' for newline

Format repetitions

```
print '( 3i4 )', i1,i2,i3
print '( 3(i2,":",f7.4) )', i1,r1,i2,r2,i3,r2
```

Repeats and line breaks

- If `abc` is a format string, then `10(abc)` gives 10 repetitions. There is no line break.
- If there is more data than specified in the format, the format is reused in a new print statement. This causes line breaks.
- The / (slash) specifier causes a line break.
- There may be a 80 character limit on output lines.

Exercise 1

Use formatted I/O to print the number $0 \cdots 99$ as follows:

```
 0  1  2  3  4  5  6  7  8  9
10 11 12 13 14 15 16 17 18 19
20 21 22 23 24 25 26 27 28 29
30 31 32 33 34 35 36 37 38 39
40 41 42 43 44 45 46 47 48 49
50 51 52 53 54 55 56 57 58 59
60 61 62 63 64 65 66 67 68 69
70 71 72 73 74 75 76 77 78 79
80 81 82 83 84 85 86 87 88 89
90 91 92 93 94 95 96 97 98 99
```