

Agenda

Number Representations

Working with bitfields

Review: Number Representations

Binary	Hex	Octal	Decimal
0100 0101			
	0xAE		
		044	
			40
	0x33		

Review: Bit fields and masking

A **bit field** stores a set of booleans within a single value

A **flag** is a value that can be true or false

Example: Suppose we store 8 flags within a character data type

```
char c = 0x45; // binary is 0100 0101  
// all flags are set to zero except for 3
```

Example: File permissions use bit fields

```
alinen@sutekh:~/cs355/os-devel$ ls -l  
-rw-r--r-- 1 alinen alinen 70 Dec 10 2023 README.md
```

Review: What does the above file permissions represent?

What numeric value corresponds to the following permissions (in octal)? -rw-r--r--

What numeric value corresponds to the following permissions (in octal)? -rwxr-x--x

System calls use bit fields to store options

Example: open() uses bit fields to set file options

```
int flags = O_CREAT | O_TRUNC | O_WRONLY;  
int perms = 0644;  
open(fds[1], flags, perms)
```

Signals use bit fields and masks to configure behavior (more soon)

Example: Permission options

Variable	Value	Definition
S_IRWXU	00700	user (file owner) has read, write, and execute permission
S_IRUSR	00400	user has read permission
S_IWUSR	00200	user has write permission
S_IXUSR	00100	user has execute permission
S_IRWXG	00070	group has read, write, and execute permission
S_IRGRP	00040	group has read permission
S_IWGRP	00020	group has write permission
S_IXGRP	00010	group has execute permission
S_IRWXO	00007	others have read, write, and execute permission
S_IROTH	00004	others have read permission
S_IWOTH	00002	others have write permission
S_IXOTH	00001	others have execute permission

Example: File permissions

What is the bit field corresponding to each of the following options?

Options	Bit Field
S_IWUSR	
S_IRWXG S_IRUSR S_IWUSR	
S_IRGRP S_IRUSR S_IROTH	
S_IRWXU S_IRUSR S_IWGRP S_IROTH	

Example: File permissions

What options correspond to the following bit fields?

Bit Field	Binary	Hex	Options
0111			
0267			
0641			
0763			

Example: Coding with bitfields

Write code that sets someone's dinner preferences to S_IRUSR and S_IWUSR

Write code that tests whether a bitfield contains the S_IRUSR option.

Write code that sets the S_IRUSR bit in an existing bitfield.