SOME POWERS OF 2

2^{10}	1,024
2^{11}	2,048
2^{12}	4,096
2^{13}	8,192
2^{14}	16,384
2^{15}	32,768

UNIX SYSTEM CALL PROTOTYPES FOR SOME COMMON SYSTEM CALLS:

```
int   fork (void);

int   pipe (int pipe_array[2]);

int   execl (char* path, char* argv0, … , NULL);

int   execlp (char* name, char* argv0, … , NULL);

int   dup (int channel);

int   open (char * path, int mode, int permissions);
```

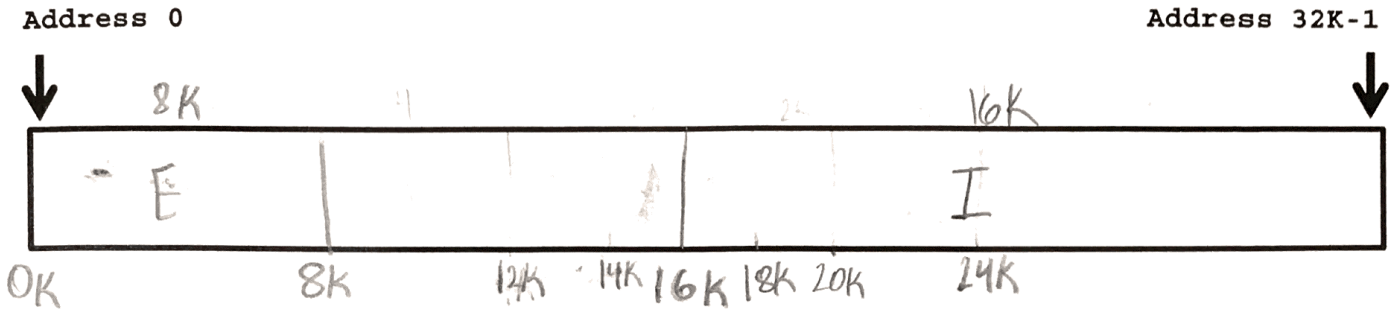
Where mode must be one of : O_RDONLY, O_WRONLY, or O_RDWR (other flags could also be OR'd in if needed), and permissions only matter if the open includes the O_CREAT flag and is both creating and opening a new file.

```
int   close (int channel);

int   read (int channel, char * buffer, int byte_count);

int   write (int channel, char * buffer, int byte_count);

int   wait (int * status);

int   exit (int exit_number);

int   sigaction(int signum, struct sigaction * new, struct sigaction * old);
```

PTHREAD ROUTINES:

```
int pthread_mutex_init(pthread_mutex_t *mutex,
            const pthread_mutexattr_t * attr);
int pthread_mutex_lock(pthread_mutex_t *mutex);

int pthread_mutex_unlock(pthread_mutex_t *mutex);

int pthread_cond_init(pthread_cond_t * cond,
            const pthread_condattr_t * attr);

int pthread_cond_wait(pthread_cond_t * cond,
            pthread_mutex_t * mutex);

int pthread_cond_signal(pthread_cond_t *cond);
int pthread_cond_broadcast(pthread_cond_t *cond);

int pthread_create(pthread_t * thread_id,
            const pthread_attr_t * attr,
            void *(*start_routine)(void*), void * arg);

int pthread_join(pthread_t thread_id, void **value_ptr);
```

HELP SHEET FOR PROBLEM #1:



2K	
4K	
8K	
16K	
32K	**0**

Scratch Memory Grid

ω	2	3	1	3	2	4	3	2	4	5	1	6	7	1	3	7	4	2	6	7	2	1
1																						
2																						
3																						
4																						
5																						
6																						
7																						
c1																						
c2																						
c3																						
c4																						
c5																						
c6																						
c7																						
∞																						

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Note: The relation 'R' imply the result relati

a)

$$R := \Pi_{model}(\sigma_{speed \geq 3.00}(PC))$$

b)

$$temp := \sigma_{hd \geq 100.00}(Laptop)$$
$$R := \Pi_{maker}(temp \bowtie Product)$$

c)

$$temp := \Pi_{model}(\sigma_{maker = 'B'}(Product))$$

$$R := (temp \bowtie \Pi_{model, price}(PC)) \cup (temp \bowtie \Pi_{model, price}(Laptop)) \cup (temp \bowtie \Pi_{model, price}(Printer))$$

d)

$$R := \Pi_{model}(\sigma_{color = 'true' \wedge type = 'laser'}(Printer))$$

e)

$$R := \Pi_{maker}(\sigma_{type = 'laptop'}(Product)) - \Pi_{maker}(\sigma_{type = 'PC'}(Product))$$

f)

$$PC1 := \rho_{pc1.model, pc1.ram, pc1.speed, pc1.hd, pc1.price}(PC)$$
$$PC2 := \rho_{pc2.model, pc2.ram, pc2.speed, pc2.hd, pc2.price}(PC)$$
$$temp := \sigma_{pc1.model \neq pc2.model \wedge pc1.hd = pc2.hd}(PC1 \times PC2)$$
$$R := \Pi_{pc1.hd}(temp)$$

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g) $PC1 := \rho_{PC1.model, PC1.ram, PC1.speed, PC1.hd, PC1.price}(PC)$

$PC2 := \rho_{PC2.model, PC2.ram, PC2.speed, PC2.hd, PC2.price}(PC)$

$temp := \sigma_{PC1.model \neq PC2.model \wedge PC1.ram = PC2.ram \wedge PC2.speed = PC2.speed}(PC1 \times PC2)$

$R := \pi_{PC1.model}(temp)$

h) $computers := \sigma_{type = 'laptop' \vee type = 'pc'}(Product)$

$laptop\_at\_least\_req := \sigma_{speed \geq 2.80}(computers \bowtie Laptop)$

$PC\_at\_least\_req := \sigma_{speed \geq 2.80}(computers \bowtie PC)$

$comp\_and\_maker := \pi_{maker, model}(laptop\_at\_least\_req) \cup \pi_{maker, model}(PC\_at\_least\_req)$

$com1 := \rho_{com1.model, com1.maker}(comp\_and\_maker)$

$com2 := \rho_{com2.model, com2.maker}(comp\_and\_maker)$

$temp := \sigma_{com1.model \neq com2.model \wedge com1.maker = com2.maker}(com1 \times com2)$

$R := \pi_{maker}(temp)$

i) $computers := \sigma_{type = 'laptop' \vee type = 'pc'}(Product)$

$laptops := \pi_{model, speed}(computers \bowtie Laptop)$

$PCs := \pi_{model, speed}(computers \bowtie PC)$

$comp_1 := \rho_{model1, speed1}(laptops \cup PCs)$

$comp2 := \rho_{model2, speed2}(laptops \cup PCs)$

$temp := \sigma_{model1 \neq model2 \wedge speed1 < speed2}(comp1 \times comp2)$

$temp2 := \pi_{model}(computers - \rho_{model}(\pi_{model}(temp)))$

$R := \pi_{maker}(temp_2 \bowtie Product)$