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OS 2019 Quiz Sheet #4

Problem 4.1: *linking* (4+1 = 5 points)

The following C source files are compiled separately into object files and afterwards linked with other object files into an executable.

```c
/* aa.c */

#include <stdio.h>

extern int x;
int y;

static void f()
{
    printf("aa.c: f()\n");
}

void g()
{
    printf("aa.c: g()\n");
    f();
}
```

```c
/* bb.c */

#include <stdio.h>

int x = 1;
static double y = 1;

void f()
{
    printf("bb.c: f()\n");
    g();
}
```

a) Which symbols defined in the files `aa.c` and `bb.c` are

- internally defined symbols not accessible outside of the object file,
- references to externally defined symbols that must be resolved by the linker,
- weak linkable symbols defined in the object file, or
- strong linkable symbols defined in the object file?

Mark the corresponding cell in the following table (ignore the `printf` symbol).

file	symbol	internal	external	weak linkable	strong linkable
aa.c	x				
aa.c	y				
aa.c	f				
aa.c	g				
bb.c	x				
bb.c	y				
bb.c	f				
bb.c	g				

b) What will be printed to the standard output by the following `main()` function? Explain.

```c
/* main.c */

int main()
{
    f();
    return 0;
}
```

Problem 4.2: *buddy system* (2+1+1+1 = 5 points)

Consider a memory allocator using the buddy system. The allocator has 1024 units of memory available. The following sequence of memory allocation requests is received:

Request	Requested	Allocated	Start
A	123		
B	273		
C	66		
D	91		

a) Fill the "Allocated" column with the size of the memory segment allocated and the "Start" column with the address where the allocated memory region starts (in case there are multiple possibilities, pick the lowest address).

b) Calculate the total internal fragmentation after the allocation of A, B, C and D.

c) Can an additional request E for 123 units of memory be granted? Explain and if possible add a row to the table above.

d) The allocations C and D are returned to the system. Can the two allocations be merged into a bigger allocation in a Buddy System? Explain why or why not.