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Memory Packing and Alignment

Compilers course

Masters in Informatics and Computing Engineering (MIEIC), 3rd Year

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You can use:

```
printf("size of s1: %d bytes \n", sizeof(struct s1));
printf("size of s2: %d bytes \n", sizeof(struct s2));
printf("size of s3: %d bytes\n", sizeof(struct s3));
```

Exercise 1

- Calvin intends to save bytes in a particular program that needs to store a large number of registers. How many bytes are needed to store each register with the type given by each of the following structs?

```
struct s1
{
    char a;
    short a1;
    char b1;
    float b;
    int c;
    char e;
    double f;
};
```

```
struct s2
{
    char a;
    char b1;
    char e;
    short a1;
    float b;
    int c;
    double f;
};
```

```
struct s3
{
    double f;
    char a;
    short a1;
    char b1;
    float b;
    int c;
    char e;
};
```

You can use:
printf("size of s1: %d bytes \n", sizeof(struct s1));
printf("size of s2: %d bytes \n", sizeof(struct s2));
printf("size of s3: %d bytes\n", sizeof(struct s3));

Exercise 1

- Calvin intends to save bytes in a particular program that needs to store a large number of registers. How many bytes are needed to store each register with the type given by each of the following structs?

```
struct s1
{
    char a;
    short a1;
    char b1;
    float b;
    int c;
    char e;
    double f;
};
```

32 bytes

```
struct s2
{
    char a;
    char b1;
    char e;
    short a1;
    float b;
    int c;
    double f;
};
```

24 bytes

```
struct s3
{
    double f;
    char a;
    short a1;
    char b1;
    float b;
    int c;
    char e;
};
```

32 bytes

Exercise 1

```
struct s1
{
        char a;
        short a1;
        char b1;
        float b;
        int c;
        char e;
        double f;
};
```

32 bytes

	a1		a
			b1
			b
			c
			e
			f


```
struct s2
{
        char a;
        char b1;
        char e;
        short a1;
        float b;
        int c;
        double f;
};
```

24 bytes

	e	b1	a
			a1
			b
			c
			f

```
struct s3
{
        double f;
        char a;
        short a1;
        char b1;
        float b;
        int c;
        char e;
};
```

32 bytes

			f	..40
				..44
	a1	..4A	a	..48
			b1	..4C
			b	..50
			c	..54
			e	..58
				..5C

More to Know

- The Lost Art of C Structure Packing, by Eric S. Raymond
  - http://www.catb.org/esr/structure-packing/
- http://c-faq.com/struct/align.esr.html
- See the use of the #pragma pack:
  - https://fresh2refresh.com/c-programming/c-structure-padding/