STRUCTS REFERENCES

Problem Solving with Computers-I

References in C++

```
int main() {
   int d = 5;
   int &e = d;
}
```

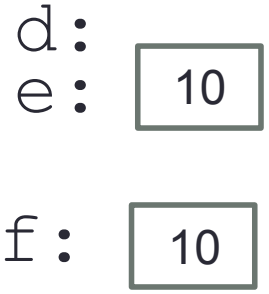
A reference in C++ is an alias for another variable

References in C++

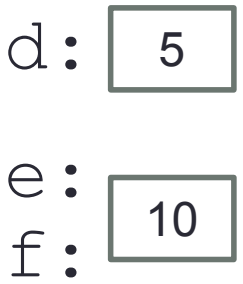
```
int main() {
   int d = 5;
   int & e = d;
   int f = 10;
   e = f;

}
```

How does the diagram change with this code?

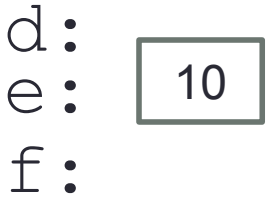
A.



B.



C.



D. Other or error

Pointers and references: Draw the diagram for this code

```
int a = 5;
int & b = a;
int* pt1 = &a;
```

What are three ways to change the value of ‘a’ to 42?

Call by reference: Modify to correctly swap a and b

```
void swapValue(int x, int y){
     int tmp = x;
     x = y;
     y = tmp;
}

int main() {
     int a=30, b=40;
     swapValue( a,  b);
     cout<<a<<" "<<b<<endl;
}
```

Call by reference: Modify to correctly swap a and b

```
void swapValue(int&x, int&y){
     int tmp = x;
     x = y;
     y = tmp;
}

int main() {
     int a=30, b=40;
     swapValue( a,  b);
     cout<<a<<" "<<b<<endl;
}
```

C++ structures (lab05)

A **`struct`** is a data structure composed of simpler data types.

```
struct Point {
    double x; //member variable of Point
    double y; //member variable of Point
};
```

Think of Point as a new data type

```
Point p1;                  // Declare a variable of type Point
Point p1 = { 10, 20};      //Declare and initialize
```

C++ structures (lab05)

- A **`struct`** is a data structure composed of simpler data types.

```
struct Point {
    double x; //member variable of Point
    double y; //member variable of Point
};
```

  - Access the member variables of p1 using the dot '.' operator

```
Point p1;
p1.x = 5;
p1.y = 10;
```

- Access via a pointer using the -> operator

```
Point* q = &p1;
(*q).x = 5;
(*q).y = 10;
```

Which of the following is/are incorrect statement(s) in C++?

```
struct Point {
    double x;
    double y;
};
```

```
struct Box {
    Point ul; // upper left corn
    double width;
    double height;
};
```

A. `ul.x = 10;`

B. `Box b1 = {{500, 800}, 10, 20};`

C. `Box b1, b2; b1.ul = {500, 800};`

D. A and C

E. None of the above are incorrect

Passing structs to functions

- Write a function that prints the x and y coordinates of a `Point`

Passing structs to functions by reference

- Write a function that takes a `Point` as parameter and initializes its x and y coordinates

Pointer Arithmetic Question

How many of the following are invalid?

I. pointer + integer (ptr+1)
II. integer + pointer (1+ptr)
III. pointer + pointer (ptr + ptr)
IV. pointer – integer (ptr – 1)
V. integer – pointer (1 – ptr)
VI. pointer – pointer (ptr – ptr)
VII. compare pointer to pointer (ptr == ptr)
VIII. compare pointer to integer (1 == ptr)
IX. compare pointer to 0 (ptr == 0)
X. compare pointer to NULL (ptr == NULL)

#invalid
A: 1
B: 2
C: 3
D: 4
E: 5

Pointer Arithmetic Question

How many of the following are invalid?

I. pointer + integer (ptr+1)
II. integer + pointer (1+ptr)
~~III. pointer + pointer (ptr + ptr)~~
IV. pointer – integer (ptr – 1)
~~V. integer – pointer (1 – ptr)~~
VI. pointer – pointer (ptr – ptr)
VII. compare pointer to pointer (ptr == ptr)
~~VIII. compare pointer to integer (1 == ptr)~~
IX. compare pointer to 0 (ptr == 0)
X. compare pointer to NULL (ptr == NULL)

#invalid
A: 1
B: 2
C: 3
D: 4
E: 5