

# COMP 520: Compilers

## Problem set 1

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1. `Object o = "abc";`

(a) `char c = o.charAt(2);`

This is not a legal Java statement, as the method `charAt` is not defined for the `Object` class to which `o` belongs.

(b) `boolean b = o.equals("abc");`

This is a legal statement as the `equals` method is defined for the `Object` class. It returns `true`, which gets assigned to `b`.

(c) `String s = o;`

This is not a legal Java statement as a variable of type `String` cannot hold the reference to an instance of the `Object` class, since `String` is a subclass of `Object`. It would have to be explicitly typecast into a `String` object.

(d) `char d = ((String) o).charAt(3);`

This is a legal Java statement, as the object is typecast explicitly into a `String` object before calling the `charAt` method on it. However, the index passed to the method is out of the range of the string, causing it to throw a run time exception.

2. The following code shows how to access each of the four occurrences of `x`:

```
interface I1 {int x = 0;}
class T1 implements I1 {int x = 1;}
class T2 extends T1 {int x = 2;}
class T3 extends T1 {
    int x = 3;
    void test() {
        /* Prints 0 */
        System.out.println(I1.x);
    }
}
```

```

    /* Prints 1 */
    System.out.println(super.x);

    /* Prints 2 */
    System.out.println(new T2().x);

    /* Prints 3 */
    System.out.println(x);
}
}

class Test {
    public static void main(String[] args) {
        new T3().test();
    }
}

```

3. ; gcd.asm  
; assemble with nasm, link with gcc

```

global _main
extern _printf

section .text
_main:
    ; Save registers we use
    push eax
    push ebx

    mov eax, 84 ; x
    mov ebx, 112 ; y

    ; arguments to printf
    push eax
    push ebx

gcd:
    cmp eax, ebx
    je print ; while (x != y) {
    jle else ; if(x > y)
    sub eax, ebx ; x = x - y
    jmp gcd ;
else: ; else
    sub ebx, eax ; y = y - x
    jmp gcd ;}

```

```

print:
    push    eax ; x and y have already been pushed above
    push    format
    call    _printf
    add     esp, 16

    ; Restore registers
    pop     ebx
    pop     eax
    ret

format:
    db      'gcd of %d and %d is %d', 10, 0

```