

# Catalog of Code Quality Defects in Introductory Programming

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defect name	description	code example	code fix example	prog. construct	defect type	tool support	lang. indep.	severity	prevalence	linter codes
redundant if-else	If-else statement with both branches being return True/False.	<pre>if c:     return True else:     return False</pre>	<pre>return c</pre>	condition	simplifiable	3	1	5	3	R6201

... and 79 more defects


# Tackling code quality in CS education by examining its smallest elements: code quality defects.

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def impose_fine(age, beer):  
    if age < 18 and beer == True:  
        return True  
    else:  
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code quality defects



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code quality defects



## Presentation outline

- catalog structure
- severity survey
- uses and future work

Redundant if-else

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if age < 18:  
    return True  
else:  
    return False
```

While as for loop

```
i = 0  
while i <= n:  
    print(i)  
    i += 1
```

Local variable used only to return

```
def kthDigit(x, k):  
    num=x//(10**(k-1))%10  
    return num
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Missing docstring



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Severity scale:

1. do not notify
2. low priority notify
3. medium notify, low fix
4. high notify, medium fix
5. high notify, high fix

# Why code quality defect catalog?

How do you eat an elephant? One bite at a time.

# Why code quality defect catalog?

How do you eat an elephant? One bite at a time.

- development of defect detectors
- development of teaching materials

# The catalog

- 80 code quality defects
- language independent defects or specific to Python
- broad, not complete (no OOP related defects)

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## Basic information

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## Categories

- defect type (what is wrong with the code)
  - 8 categories: unused, simplifiable, unsuited construct, duplicate code, poor design, poor name, poor formatting, poor documentation

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  - 8 categories: expressions, variables, conditions, loops, functions, compound data structures, modules, multiple
- also considered: what is the reason for correcting (but multiple)

defect name	tool support	language independence	severity	prevalence
redundant if-else	3	1	5	3

## Importance rankings (low–high)

- tool support (1–3)
- language independence (0/1)
- severity (1–5)
- prevalence (1–3)

defect name	linter codes
redundant if-else	R6201

## Bonus: linter codes

# Severity survey

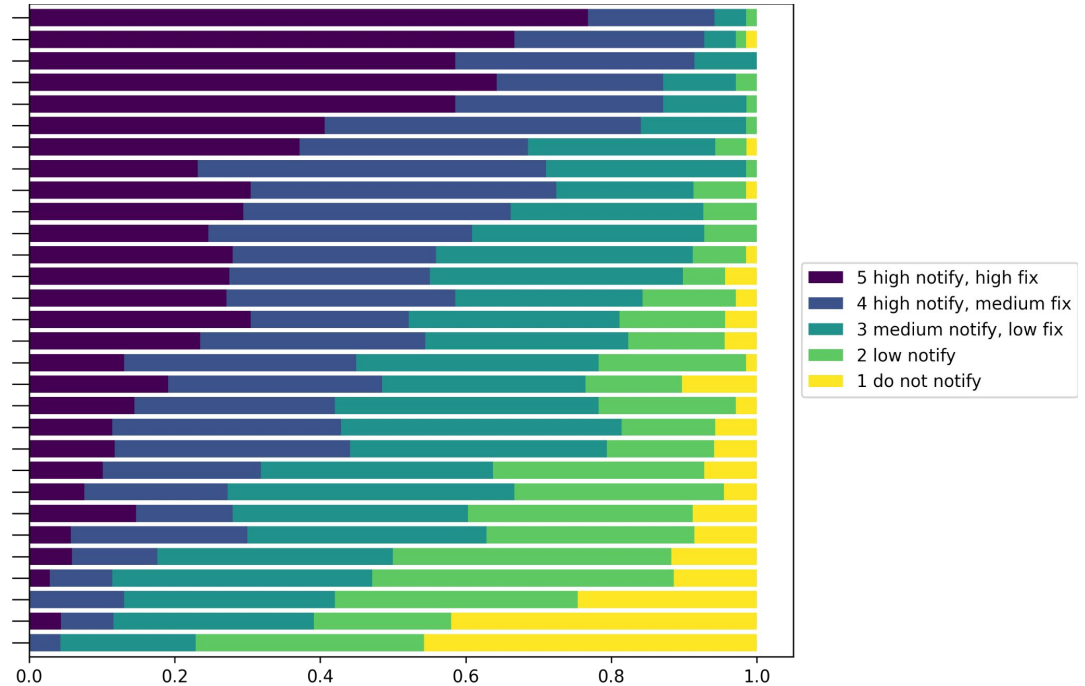
Should student be notified about the defect? Should they fix it?

- 30 defects, 72 respondents
- 1 (do not notify)  
to 5 (high priority fix)

# Severity survey

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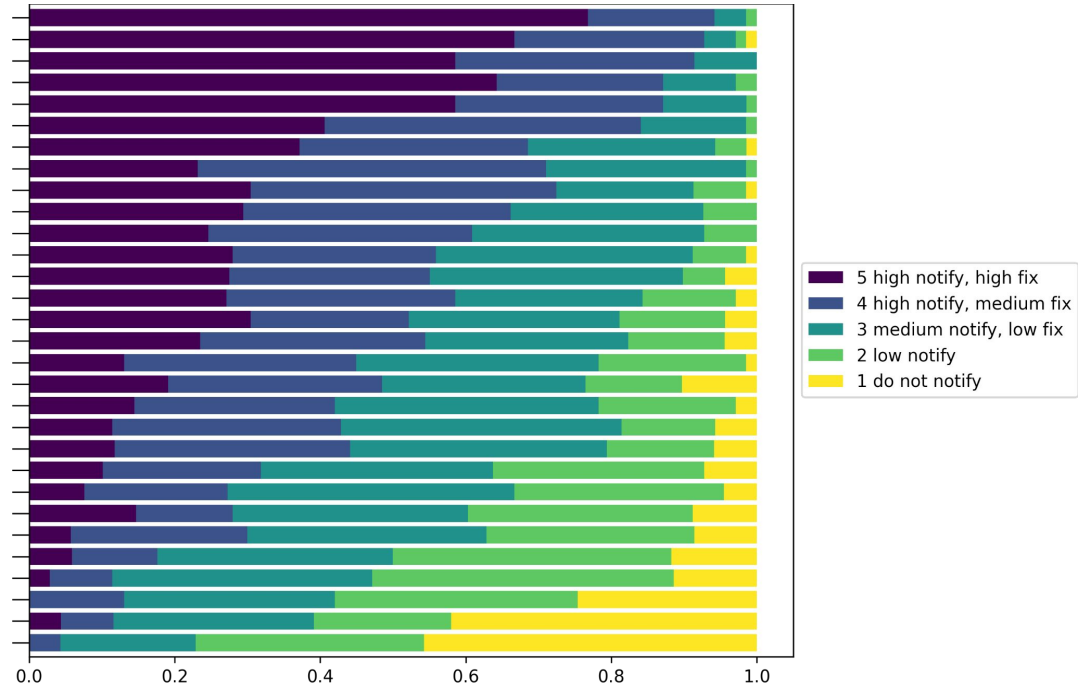
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# Severity survey

Should student be notified about the defect? Should they fix it?

- 30 defects, 72 respondents
- 1 (do not notify)  
to 5 (high priority fix)
- Big differences in individual  
opinions, relative order is stable.



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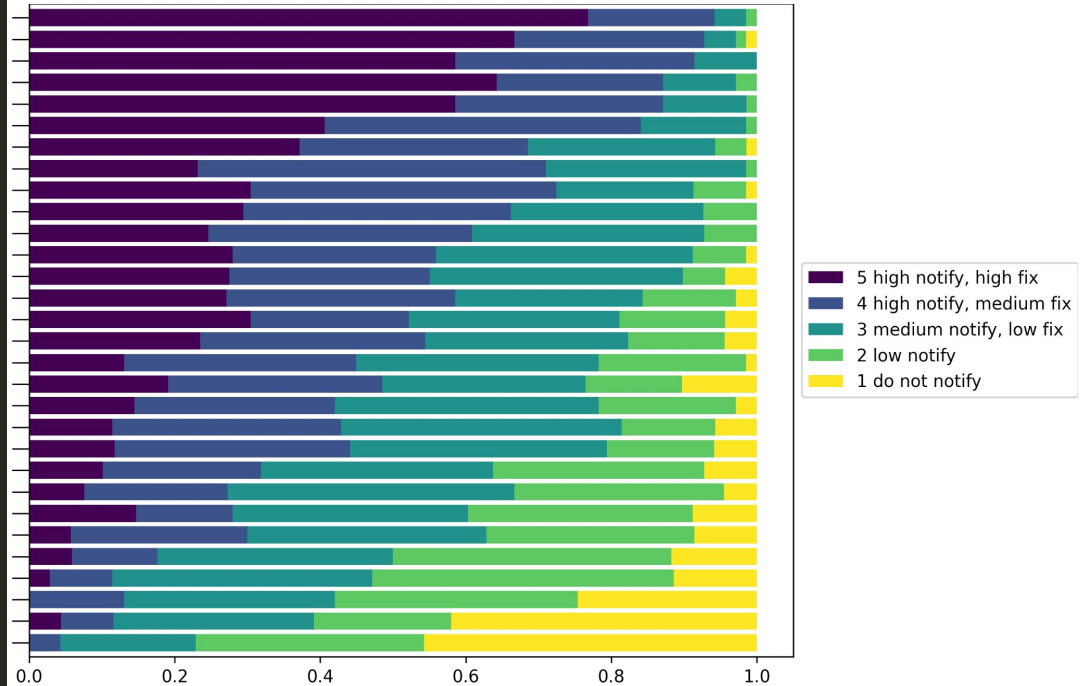
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# Severity survey

sorted by average severity



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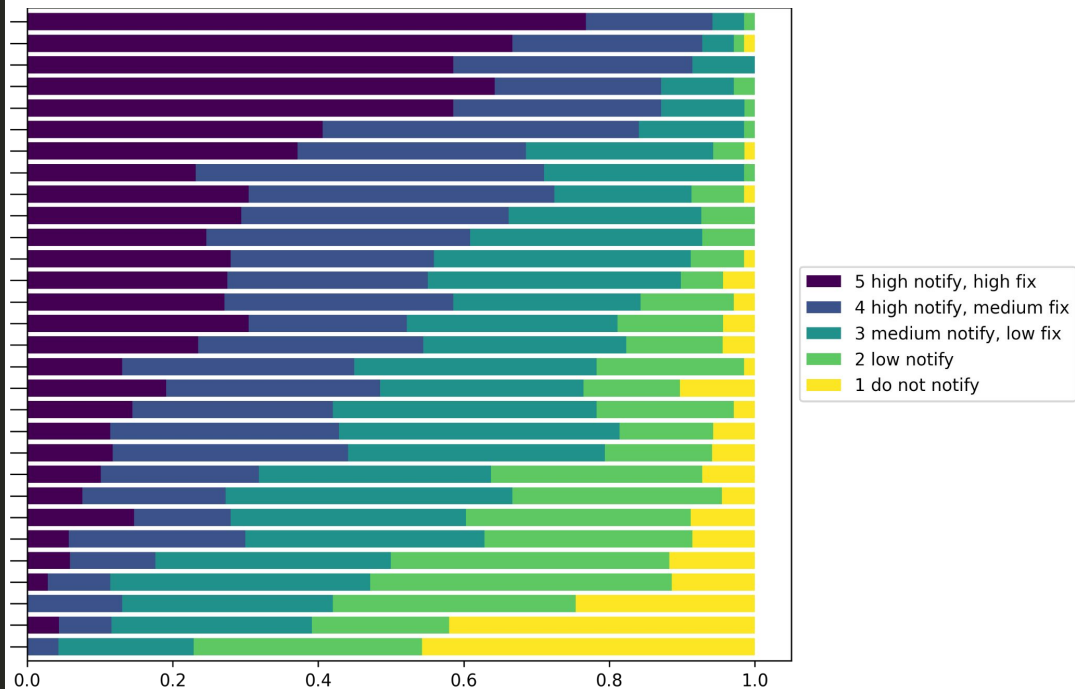
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Block with no effect

```
for number in [1, 2, 3]:  
    break
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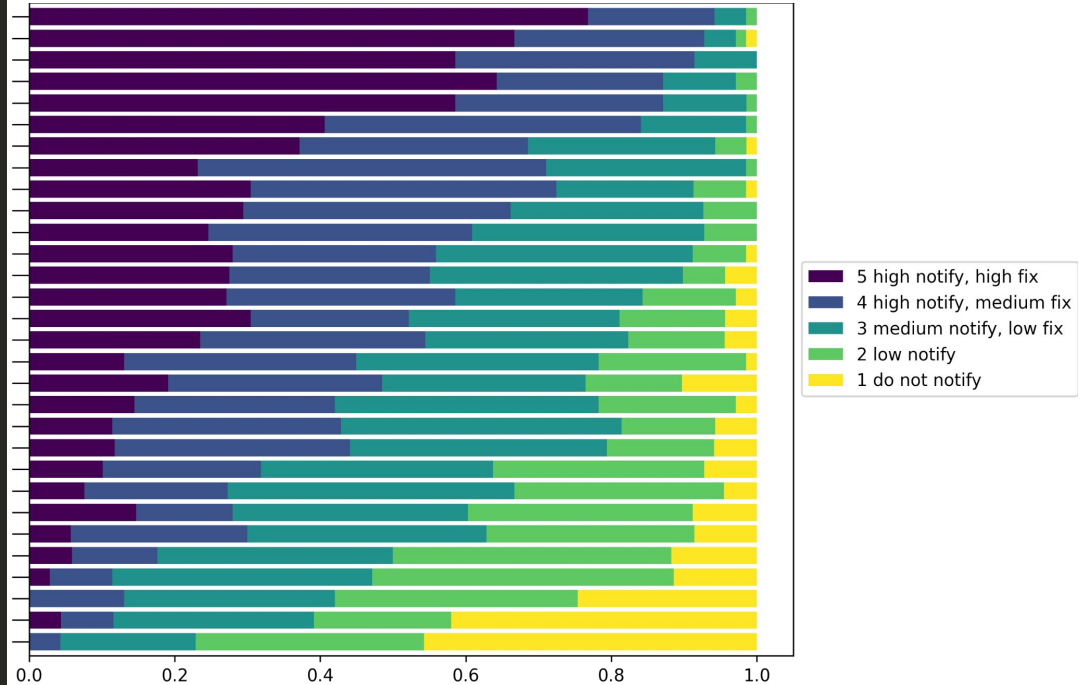
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# Possible uses

Resource for teachers

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Resource for researchers analyzing code quality

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We are not done!

Expanding catalog, refining form, adding examples, accepting feedback...

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[rehtackova.cz/research/iticse24](https://rehtackova.cz/research/iticse24)

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