[Software Development]

Development Tools

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IMPORTANT. The deadline for the homework is

January, Monday 18 at 9:00 AM

(extension to Wednesday at 1pm **ONLY** for Dev3)

Homework Status

- 114 registered students
  - 96% completed at least one challenge
  - 90 command line ninjas
  - 62 python masters
  - 14 dev fu
- 3280 (+25%) Submissions
  - 21.4% (-2%) of which were correct

Comparing Files

```
diff [options]  fileA fileB
```

- `diff` compares two files line by line
- If there is no difference, it says nothing ("*silence is gold*")
- Otherwise it prints the different lines to the standard output in a particular format (the format depends on the options)
  - By default, it prints the output in *normal* format, suitable for a machine
  - `-u` produce the output in a *unified* format including context lines for each change
    - more human readable
    - most common format nowadays
  - The output of `diff` is called a patch, because it contains all the information required to transform one file to the other

hello1.c

```
void main(){
    printf("Hello World");
}
//end
```

hello2.c

```
#include <stdio.c>

void main(){
    printf("Hello World\n");
}
```

normal form

```
balzarot> diff hello1.c hello2.c
0a1,2
> #include <stdio.c>
>
2c4
<      printf("Hello World");
---
>      printf("Hello World\n");
4d5
<      //end
```

hello1.c

```
void main(){
    printf("Hello World");
}
//end
```

hello2.c

```
#include <stdio.c>

void main(){
    printf("Hello World\n");
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normal form

```
balzarot> diff hello1.c hello2.c
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>     printf("Hello World\n");
4d5
<     //end
```

Command format:
`linerange-f1 command linerange-f2`
a = add
c = change
d = delete

`diff` is line based
Also if you change a single character, it substitutes the entire line

< identifies the first file
> identifies the second file

hello1.c

```
void main(){
    printf("Hello World");
}
//end
```

hello2.c

```
#include <stdio.c>

void main(){
    printf("Hello World\n");
}
```

unified form

```
balzarot> diff -u hello1.c hello2.c
--- hello1.c    2009-12-07 15:20:45.000000000 +0100
+++ hello2.c  2009-12-07 15:21:38.000000000 +0100
@@ -1,3 +1,5 @@
+#include <stdio.h>
+
 void main(){
-    printf("Hello World");
+    printf("Hello World\n");
 }
- //end
```

From one Version to Another

```
cat patchfile | patch original-file
```

- patch takes a file produced by the diff program and applies those differences to one or more original files, producing patched versions
  - It is usually able to automatically determine the format of the `diff` file
  - ignores leading and trailing “garbage”
    - You can feed patch with an email, an online forum message.. and it should still work
  - `-b` – create a backup of the original files
  - `-R` – reverse the patch

Patching Entire Projects

- `diff` can also produce a list of changes between two directories trees
  - `diff -u -r directoryA/ directoryB/`
    Produce one patch file containing all the differences between the files in the two directories
  - By default, it does **not include** in the patch the full content of new files. When you need it, use the `-N` option
- `patch` tries to apply each single patch as if they came from separate patch files
  - It tries to guess the name of the file to patch. Much easier if you use diff in unified form
  - By default, it consider filename without the path. Use the `-p` option to change this behavior

Patching Entire Projects

- `-p num` or `--strip=num`

  Strip the smallest prefix containing num leading slashes from each file name found in the patch file. For example, supposing the file name in the patch file was: `/u/howard/src/blurfl/blurfl.c`

  - `-p0` gives the entire file name unmodified,
  - `-p1` gives `u/howard/src/blurfl/blurfl.c` without the leading slash
  - `-p4` gives `blurfl/blurfl.c`
  - not specifying -p at all just gives you `blurfl.c`.
- Whatever you end up with is looked for in the current directory

```
balzarot> diff -Nur  myproj_v1/  myproj_v2/ > patch_1_2
balzarot> patch < patch_1_2
Can't find file to patch at input line 4
Perhaps you should have used the -p or --strip option?
…

balzarot> patch -p0 < patch_1_2
patching file myproj_v1/fileA
patching file myproj_v1/subdir/fileB
```

Sending Patches

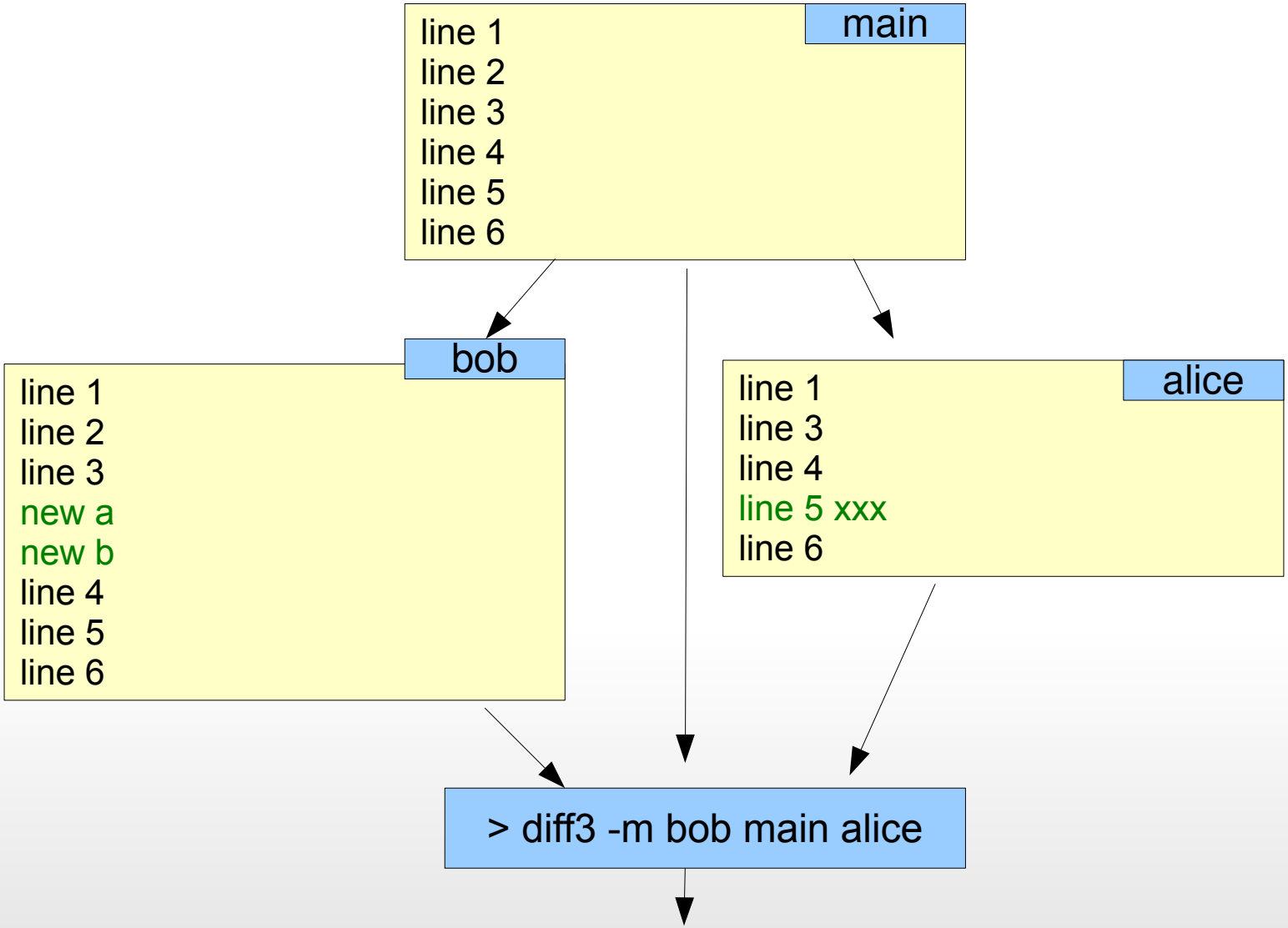
- `diff` and `patch` play a vital role in software development and are at the heart of Open Source development
  - The program maintainer places the source code of the program on the Internet for free use
  - A user identifies a bug in the program and fix it
  - To share the improved version with the community, he runs diff on the original version and his modified version to produce a patch that fix the bug
  - He then sends the patch to the original author, who can then approve the patch, apply it to his version, and finally post the corrected version

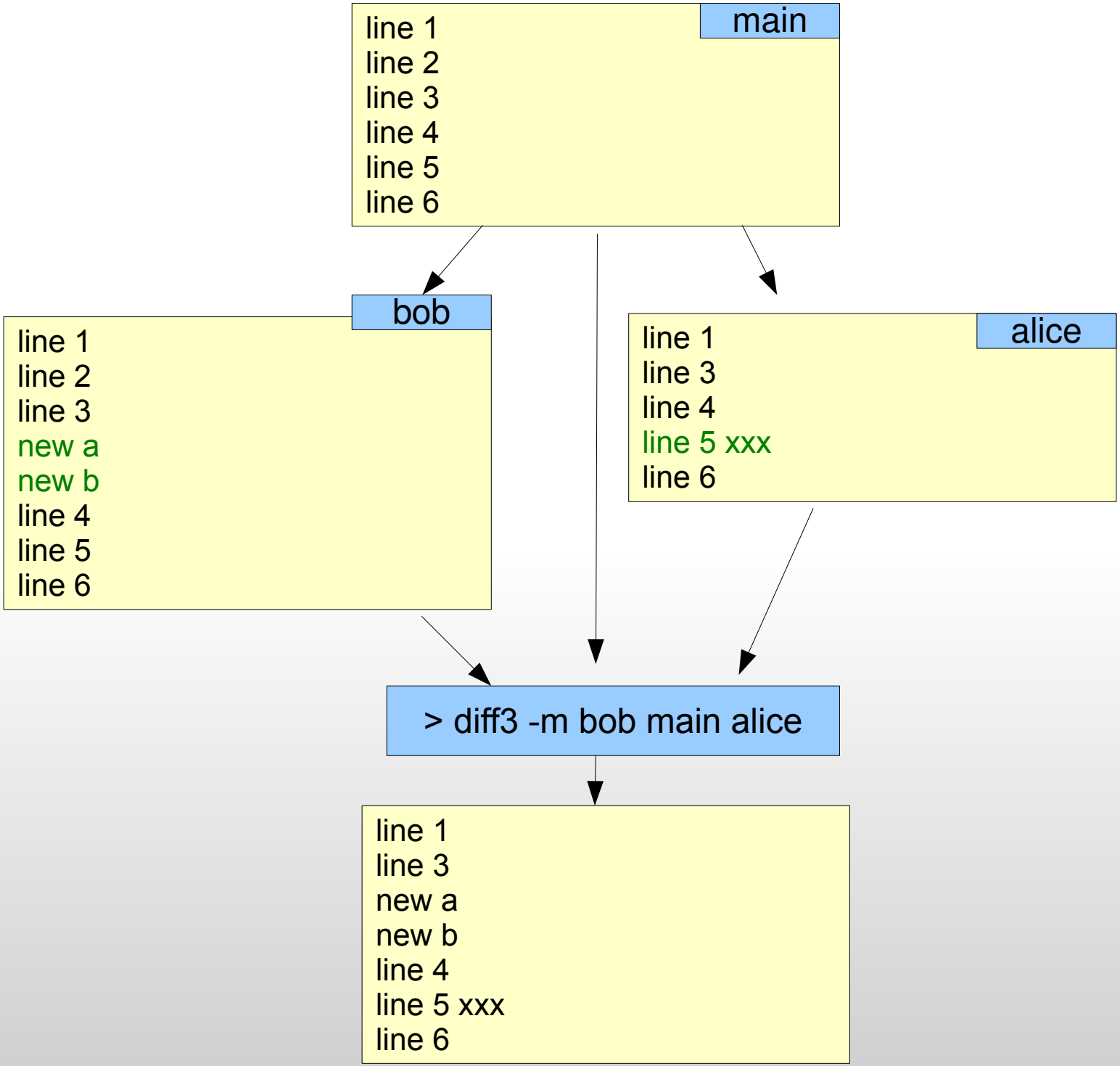
Three-way Comparison

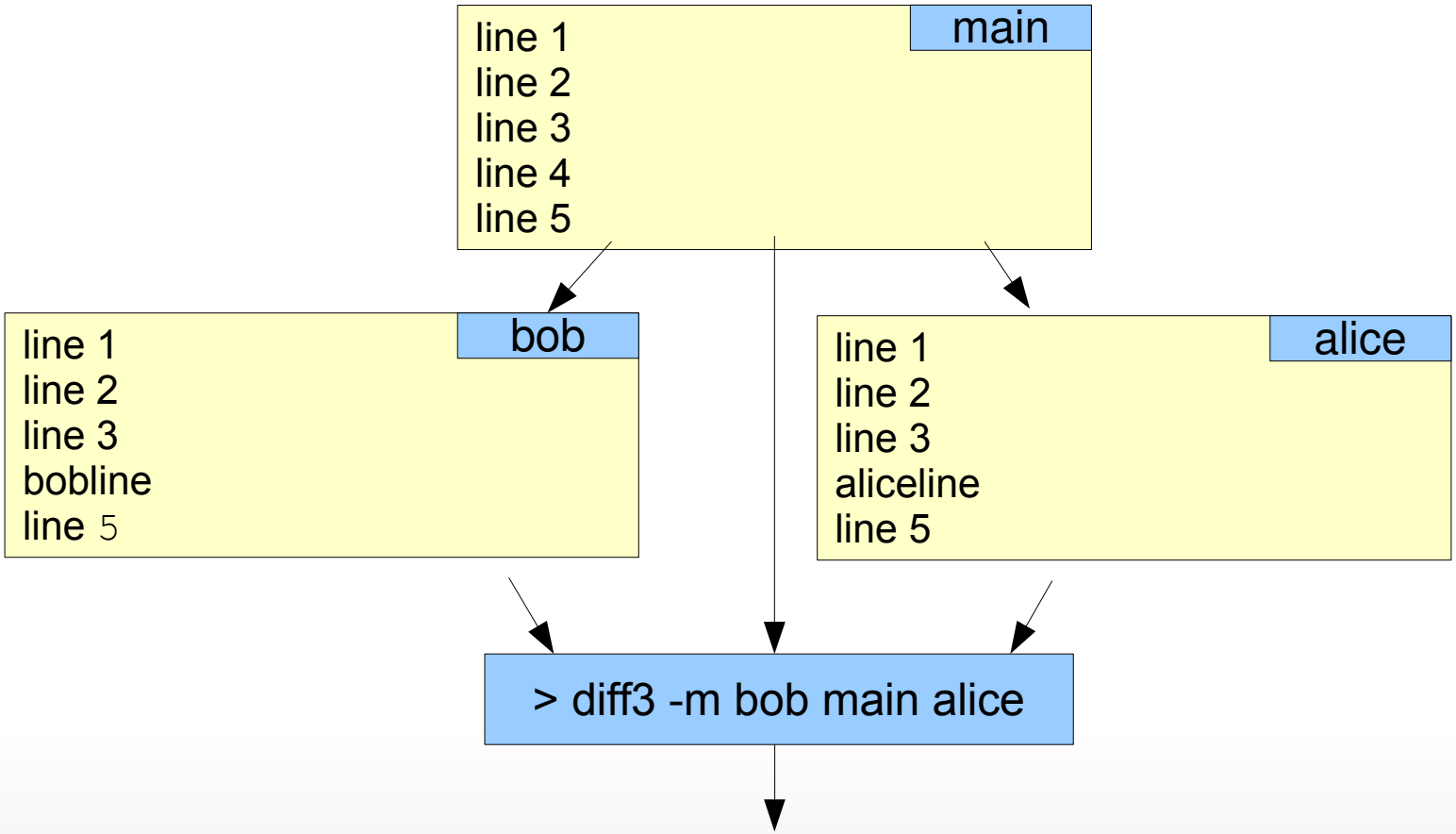
- When two people have made independent changes to the same original file, `diff3` can report the differences between the original and the two changed versions
- The output of `diff3` cannot be used for patching but..
- `diff3` can also produce a merged file that contains both users changes (with warnings about conflicts)

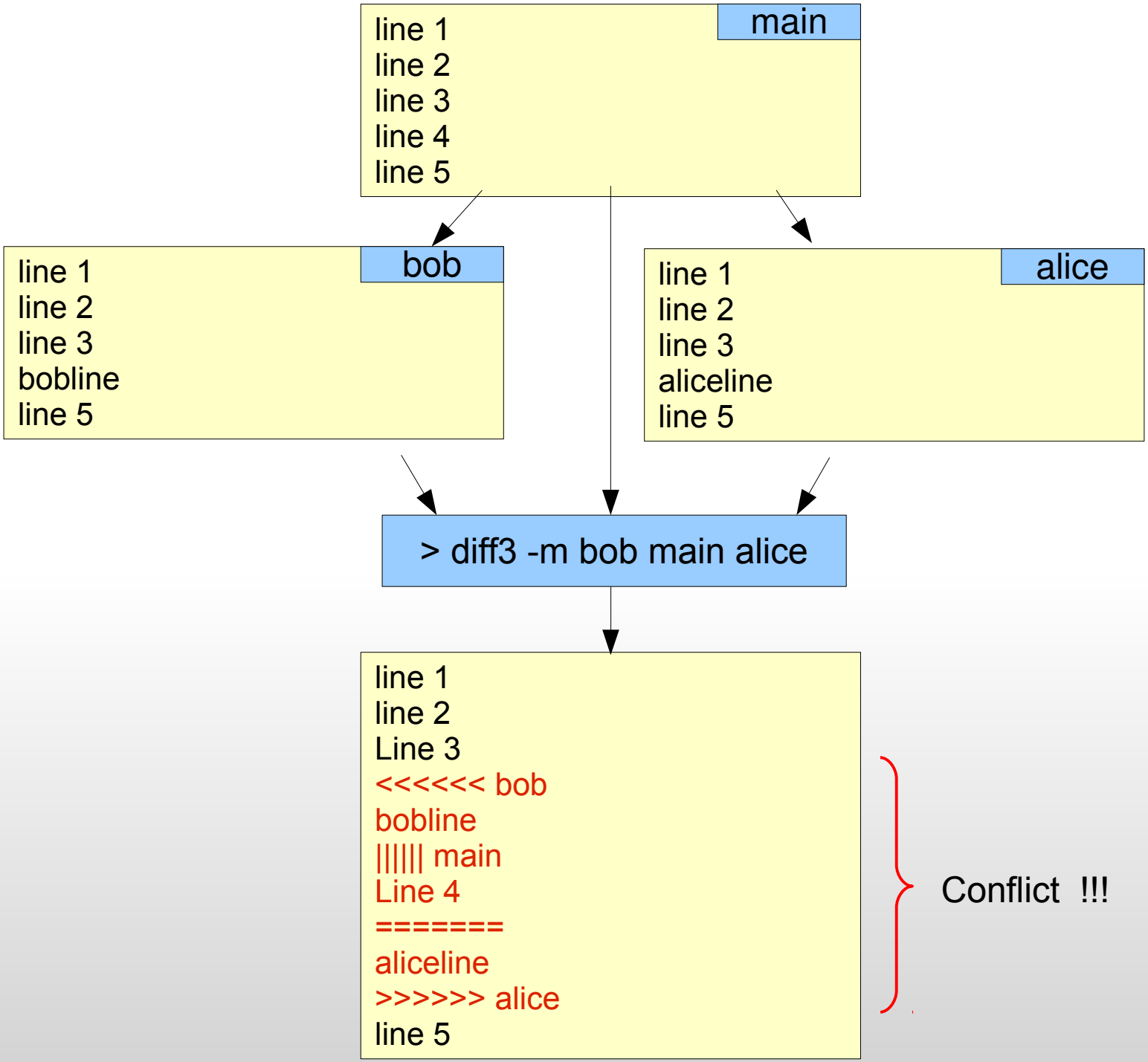
```
diff3 -m mine older yours
```

merge into “mine” the changes that would turn “older” into “yours”


main
line 1
line 2
line 3
line 4
line 5
line 6
bob
line 1
line 2
line 3
new a
new b
line 4
line 5
line 6
alice
line 1
line 3
line 4
line 5 xxx
line 6
> diff3 -m bob main alice


main
line 1
line 2
line 3
line 4
line 5
line 6
bob
line 1
line 2
line 3
new a
new b
line 4
line 5
line 6
alice
line 1
line 3
line 4
line 5 xxx
line 6
> diff3 -m bob main alice
line 1
line 3
new a
new b
line 4
line 5 xxx
line 6


main
line 1
line 2
line 3
line 4
line 5
bob
line 1
line 2
line 3
bobline
line 5
alice
line 1
line 2
line 3
aliceline
line 5
> diff3 -m bob main alice


main
line 1
line 2
line 3
line 4
line 5
bob
line 1
line 2
line 3
bobline
line 5
alice
line 1
line 2
line 3
aliceline
line 5
> diff3 -m bob main alice
line 1
line 2
Line 3
<<<<<< bob
bobline
|||||| main
Line 4
=======
aliceline
>>>>>> alice
line 5
Conflict !!!

Working with Binary Files

- `diff/patch` are line-based and do not work with binary data
  - because there is no end of lines in binary files
  - If `diff` finds that one of the files contains binary data, it just prints if it is different from the other file
    - But it does not generate a patch !

- For creating patches for binary file you can use `bsdiff` and `bspatch` instead
  - Creates quite compact binary patches
  - Requires a lot of memory (>17 times the size of one file)
    - Suitable for patching executables, not to create a diff of ISO files