

# CS5250 Advanced Operating Systems

## Pop Quiz 3

(Due: 1 Feb 2021, 11pm)

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1. Refer to slide 39 of Lecture slide deck 4 "Linking and Loading".

Assuming that **maskwords** = 4, **shift2** = 7, and **C** = 64, compute **N**, and **BITMASK** (in hexadecimal) for the string "**printf**". Use the hash function on the same slide. Write down any assumptions that you feel you needed to make.

$h1 = 359345080$

$h2 = 2807383$

$n = 2$

$BITMASK = 1800000$

2. (I have already mentioned this in the recording but I want to make sure it "sank in" for you.) For a general Bloom filter using a bit vector of  $m$  bits and  $k$  hashes, argue why:

- a) If the Bloom filter returns "no, not in the set" for an element  $e$ , it must be that  $e$  is not in the set.
- b) If the Bloom filter returns "yes, may be in the set" for an element  $e$ ,  $e$  may (true positive) or may not (false positive) be in the set. In particular, what would be the worst case scenario for false positives?

a. The contraposition is if  $e$  is in the set, bloom filter will return yes, it may be in the set. In this case it's true since once  $e$  is in the set, it will change all the bit in the vector for every hashes to true. So once the bloom filter checks, it will return yes.

b. The worst case scenario is let say  $k=2$  and we have 3 element  $\{a, b, e\}$ . Let  $h1(a) = x$  and  $h2(b) = y$  and  $h1(e) = y$  and  $h2(e) = x$ .

If we add  $a$  and  $b$  to the set and check for  $e$ , the bloom filter will return true even though it's not there. Even worse, if the hash function is bad, let all element  $x$  will be hashed into 1 value, even with  $k=1$ , this will give false positive