

## note\_on\_distribution\_of\_nprobes\_filling\_rate\_9

November 15, 2022

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[1]: import os
import importlib

[2]: # work here

# Edit filling rate for the c files
for k in range(5, 30):

    filling_rate = 0.9
    lines = []
    with open("include/config.h", "r") as f:
        for line in f:
            if line[:20] == "#define FILLING_RATE":
                line = "#define FILLING_RATE " + str(filling_rate) + "\n"
            if line[:19] == "#define K_DICT_SIZE":
                line = "#define K_DICT_SIZE " + str(k) + "\n"

            lines.append(line)

    with open("include/config.h", "w") as f:
        f.writelines(lines)

# compile and save data in data.py
os.system("make clean -s")
os.system("make -s")
os.system(f"./main > data.py")

# load the data, and process them
import data # data is created after calling c code
importlib.reload(data)

# mean for poisson is the first element since
#  $Pr(X=0) = \text{mean}$ 
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# print(data.mean)

nelements = float(sum(data.r_seq))
r_seq_prob = [i/nelements for i in data.r_seq]

print(f"ith-entry:=Pr(nprobes<=i): nslots=2^{k}, ceil(40*mean) {int(40*data.
↪mean+1)}")
r_seq_cum = [sum(r_seq_prob[:i]) for i in range(len(r_seq_prob))]
print(r_seq_cum[:int(40*data.mean+1)])
print("")

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ith-entry:=Pr(nprobes<=i): nslots=2^5, ceil(40*mean) 23
[0, 0.5625, 0.65625, 0.6875, 0.71875, 0.75, 0.78125, 0.84375, 0.875, 0.875,
0.90625, 0.9375, 0.9375, 0.96875, 0.96875, 0.96875, 0.96875, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0]

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ith-entry:=Pr(nprobes<=i): nslots=2^6, ceil(40*mean) 23
[0, 0.5625, 0.65625, 0.6875, 0.71875, 0.75, 0.78125, 0.84375, 0.875, 0.875,
0.90625, 0.9375, 0.9375, 0.96875, 0.96875, 0.96875, 0.96875, 1.0, 1.0, 1.0, 1.0,
1.0, 1.0]

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ith-entry:=Pr(nprobes<=i): nslots=2^7, ceil(40*mean) 23
[0, 0.5625, 0.6640625, 0.703125, 0.75, 0.7734375, 0.7890625, 0.8125, 0.828125,
0.8359375, 0.8359375, 0.8359375, 0.8671875, 0.8671875, 0.8828125, 0.890625,
0.90625, 0.90625, 0.9140625, 0.9140625, 0.9140625, 0.9140625, 0.921875]

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ith-entry:=Pr(nprobes<=i): nslots=2^8, ceil(40*mean) 23
[0, 0.56640625, 0.69140625, 0.7578125, 0.79296875, 0.82421875, 0.84765625,
0.875, 0.8984375, 0.91015625, 0.91796875, 0.921875, 0.93359375, 0.94140625,
0.94921875, 0.96484375, 0.96875, 0.97265625, 0.97265625, 0.97265625, 0.97265625,
0.97265625, 0.97265625]

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ith-entry:=Pr(nprobes<=i): nslots=2^9, ceil(40*mean) 22
[0, 0.548828125, 0.67578125, 0.755859375, 0.794921875, 0.8203125, 0.8359375,
0.84375, 0.857421875, 0.869140625, 0.87109375, 0.87890625, 0.888671875,
0.8984375, 0.912109375, 0.91796875, 0.921875, 0.923828125, 0.923828125,
0.92578125, 0.931640625, 0.93359375]

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ith-entry:=Pr(nprobes<=i): nslots=2^10, ceil(40*mean) 22
[0, 0.5498046875, 0.6943359375, 0.7578125, 0.8017578125, 0.8330078125,
0.8544921875, 0.87109375, 0.8896484375, 0.8984375, 0.904296875, 0.908203125,
0.9150390625, 0.9189453125, 0.921875, 0.92578125, 0.927734375, 0.935546875,
0.939453125, 0.94140625, 0.9462890625, 0.953125]

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ith-entry:=Pr(nprobes<=i): nslots=2^11, ceil(40*mean) 23

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[0, 0.56201171875, 0.708984375, 0.77099609375, 0.80712890625, 0.8359375, 0.85400390625, 0.875, 0.89111328125, 0.90087890625, 0.91162109375, 0.9189453125, 0.92578125, 0.9296875, 0.9365234375, 0.939453125, 0.943359375, 0.9462890625, 0.9501953125, 0.95361328125, 0.9560546875, 0.9619140625, 0.9638671875]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>12</sup>, ceil(40\*mean) 23

[0, 0.55517578125, 0.69677734375, 0.768798828125, 0.810791015625, 0.83984375, 0.861328125, 0.8779296875, 0.89111328125, 0.903076171875, 0.9130859375, 0.9208984375, 0.925537109375, 0.9306640625, 0.937744140625, 0.94140625, 0.945556640625, 0.94775390625, 0.94921875, 0.950927734375, 0.9521484375, 0.9541015625, 0.956298828125]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>13</sup>, ceil(40\*mean) 22

[0, 0.5467529296875, 0.6907958984375, 0.757568359375, 0.8017578125, 0.83056640625, 0.8548583984375, 0.8697509765625, 0.8824462890625, 0.8939208984375, 0.9034423828125, 0.911865234375, 0.91796875, 0.9229736328125, 0.9293212890625, 0.93359375, 0.9373779296875, 0.9405517578125, 0.9447021484375, 0.9476318359375, 0.9498291015625, 0.9527587890625]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>14</sup>, ceil(40\*mean) 23

[0, 0.5513916015625, 0.69183349609375, 0.76165771484375, 0.8031005859375, 0.8299560546875, 0.8516845703125, 0.868408203125, 0.88055419921875, 0.88922119140625, 0.89788818359375, 0.906005859375, 0.91314697265625, 0.91888427734375, 0.92364501953125, 0.927734375, 0.93182373046875, 0.9356689453125, 0.93902587890625, 0.94207763671875, 0.9442138671875, 0.9466552734375, 0.94976806640625]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>15</sup>, ceil(40\*mean) 23

[0, 0.55157470703125, 0.6976318359375, 0.7647705078125, 0.806121826171875, 0.83502197265625, 0.856903076171875, 0.8721923828125, 0.884857177734375, 0.89544677734375, 0.903961181640625, 0.91131591796875, 0.91729736328125, 0.922760009765625, 0.92724609375, 0.931884765625, 0.93585205078125, 0.938720703125, 0.94146728515625, 0.944305419921875, 0.947113037109375, 0.9500732421875, 0.952301025390625]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>16</sup>, ceil(40\*mean) 22

[0, 0.548553466796875, 0.69268798828125, 0.76263427734375, 0.8048858642578125, 0.83306884765625, 0.8549041748046875, 0.869720458984375, 0.88287353515625, 0.8929290771484375, 0.9020233154296875, 0.909393310546875, 0.9158782958984375, 0.92132568359375, 0.9265899658203125, 0.9307708740234375, 0.934417724609375, 0.9380340576171875, 0.94158935546875, 0.944549560546875, 0.947113037109375, 0.9493560791015625]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>17</sup>, ceil(40\*mean) 22

[0, 0.5486526489257812, 0.6914138793945312, 0.761688232421875, 0.8033523559570312, 0.8322830200195312, 0.8528900146484375, 0.8689804077148438, 0.8822479248046875, 0.8927841186523438, 0.9018936157226562, 0.9094772338867188, 0.915557861328125, 0.9210433959960938, 0.9263992309570312, 0.9312744140625,

0.9352188110351562, 0.938507080078125, 0.9418182373046875, 0.9447402954101562,  
0.9473495483398438, 0.9495697021484375]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>18</sup>, ceil(40\*mean) 22  
[0, 0.5494045212136933, 0.6930137101265725, 0.7620564426913656,  
0.8034843710660633, 0.8317629376444826, 0.8530605549663921, 0.8692922156693699,  
0.8822393969680553, 0.8925238992607059, 0.9015495418513628, 0.9089539257349069,  
0.915469478374316, 0.9209054634511065, 0.9261125649457163, 0.9307627163903531,  
0.935187798979179, 0.9385562023636043, 0.9417567577877637, 0.9447055412715244,  
0.9473987380885167, 0.949832533512371]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>19</sup>, ceil(40\*mean) 22  
[0, 0.5497637744212617, 0.6930021152536684, 0.762208485047312,  
0.8034187382101788, 0.8323647162718131, 0.8533856456482806, 0.869405497370715,  
0.8821714061191677, 0.8929422243923654, 0.9020250359059067, 0.9095361891483101,  
0.9160402603917321, 0.9218195377722508, 0.9268892801080325, 0.9312590241604313,  
0.9352358536450456, 0.9388750817777286, 0.942142376217606, 0.9450949575328017,  
0.9478796918481671, 0.9504679688796404]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>20</sup>, ceil(40\*mean) 23  
[0, 0.5505771636962891, 0.69415283203125, 0.7631645202636719,  
0.8049411773681641, 0.8334522247314453, 0.8546619415283203, 0.8707599639892578,  
0.8837251663208008, 0.8943347930908203, 0.903076171875, 0.9106130599975586,  
0.9170083999633789, 0.922642707824707, 0.9276018142700195, 0.932002067565918,  
0.936004638671875, 0.9395580291748047, 0.9427061080932617, 0.9456148147583008,  
0.9483203887939453, 0.9507646560668945, 0.9530353546142578]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>21</sup>, ceil(40\*mean) 22  
[0, 0.5498548029468564, 0.6933252270939131, 0.7624104141334668,  
0.8045928998879431, 0.8330376940133037, 0.853880266075388, 0.8702539160288963,  
0.8829993085854612, 0.8936981141072408, 0.9026021028538731, 0.9101513959421119,  
0.9165186085878454, 0.9221781942159597, 0.9271134635100016, 0.9315666499773501,  
0.9355606418234269, 0.9391617194764321, 0.9424395012278567, 0.9453954175905394,  
0.9481071930953912, 0.9506163126147389]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>22</sup>, ceil(40\*mean) 23  
[0, 0.5500813842013799, 0.693760560455456, 0.7629165084162971,  
0.8047859203305054, 0.8333637317094164, 0.8542310844018661, 0.870364635077628,  
0.8832127769500678, 0.8937854513610486, 0.9025954967964881, 0.9101781630940827,  
0.9167103568817037, 0.9224278741903006, 0.9274701899219013, 0.9318785505005243,  
0.9358775462812297, 0.9394862507548931, 0.9427227837378465, 0.945672260683122,  
0.9483368273584433, 0.9507958771695799, 0.9531140215668731]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>23</sup>, ceil(40\*mean) 22  
[0, 0.5499802827835083, 0.693606972694397, 0.7626832723617554,  
0.8044877052307129, 0.8330135345458984, 0.8540076017379761, 0.8701635599136353,  
0.8830453157424927, 0.893634557723999, 0.9024965763092041, 0.910057783126831,  
0.9165501594543457, 0.9222251176834106, 0.927212119102478, 0.9316458702087402,

0.9356198310852051, 0.9392060041427612, 0.9424617290496826, 0.9454113245010376,  
0.9481322765350342, 0.9505890607833862]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>24</sup>, ceil(40\*mean) 23  
[0, 0.5500075817198535, 0.6935181540467191, 0.7626829894578331,  
0.8044334702890756, 0.8329109941852022, 0.8538768337688847, 0.8700524211554778,  
0.8828940187621338, 0.8934701603295327, 0.9023133543888976, 0.9098572252478898,  
0.9163279728030832, 0.9220147395309679, 0.9270163500503896, 0.9314507024892597,  
0.9354218666814167, 0.9390094149224935, 0.9422281291820157, 0.9451861324144987,  
0.9478878949736296, 0.9503446225459843, 0.9526419075034944]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>25</sup>, ceil(40\*mean) 22  
[0, 0.5499114988651851, 0.6933802247885908, 0.7624503000681997,  
0.8042413668180111, 0.8327768733087897, 0.8537488944808742, 0.8698931990144235,  
0.8827910711605629, 0.8933801830652649, 0.9022487740196716, 0.9098066266893625,  
0.9163196676725167, 0.9219915067997696, 0.9269879346870208, 0.9314458932505129,  
0.9354067481876877, 0.9389980238640734, 0.9422598044749577, 0.9452027294684578,  
0.9479164443906146, 0.9504123337489373]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>26</sup>, ceil(40\*mean) 23  
[0, 0.5500205174278033, 0.6934284715736694, 0.7624685954012412,  
0.8043054322441937, 0.8328247611989856, 0.8537825634258828, 0.8699557920881974,  
0.882841061594275, 0.8934217451832921, 0.902276410775445, 0.9097998799024903,  
0.9162988336462928, 0.9219710404009299, 0.9269763599713791, 0.9314397089073353,  
0.9354235231318837, 0.9390020104963281, 0.9422451022147588, 0.9452038497125907,  
0.9479008878745893, 0.9503672409470223, 0.9526588479406921]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>27</sup>, ceil(40\*mean) 23  
[0, 0.55001332873175, 0.693466081277838, 0.7624838852135091, 0.804321030366434,  
0.8328752276406493, 0.8538209278127974, 0.8699767260726243, 0.8828742922191611,  
0.8934486305075511, 0.9023066137890396, 0.9098498958828573, 0.9163594757649131,  
0.922045944342116, 0.9270415048712214, 0.931489417283524, 0.9354739030406086,  
0.9390529426285028, 0.9423043276502151, 0.9452636719226576, 0.9479639890070727,  
0.9504501314511198, 0.9527342064624311]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>28</sup>, ceil(40\*mean) 23  
[0, 0.5500022586458807, 0.6934344081152345, 0.7624802366622788,  
0.8043346808194368, 0.8328891466362005, 0.8538498945000405, 0.8699923952589015,  
0.8828884697502422, 0.8934660552346243, 0.9023303630097298, 0.9098717107766212,  
0.9163693205123706, 0.9220553041234454, 0.9270627216685098, 0.9315080705481614,  
0.9354861930277438, 0.9390713118691368, 0.9423124295924051, 0.9452654963913187,  
0.947964483223797, 0.9504442923713121, 0.9527262734949931]

ith-entry:=Pr(nprobes<=i): nslots=2<sup>29</sup>, ceil(40\*mean) 23  
[0, 0.5500295624476121, 0.6934752467661203, 0.7625144211740856,  
0.8043386889111854, 0.8328965456490818, 0.8538498356407486, 0.8700071646355343,  
0.8829102644188757, 0.8934882495342973, 0.9023454372674029, 0.9098812388011126,  
0.916392055335466, 0.9220705274407657, 0.9270748143607483, 0.9315215662443728,

0.9354998697860535, 0.9390811891742283, 0.942327772218562, 0.9452841920686184,  
0.947986781522366, 0.9504646984604266, 0.9527500996255527]

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