Q1)
Part a)
i) I decided to use the iteration way to implement the fib function. And also, the integer only have 32 bits , which cannot take care fib(100) 's case. Therefore, I changed it to Biginteger.

ii) O(n) . Because it only use one for-loop to make the calculation .

iii)
       fib(0): 0
       fib(1): 1
       fib(2): 1
       fib(3): 2
       fib(5): 5
       fib(10): 55
       fib(100): 354224848179261915075

Part b)

iii.)
$O(n^2)$.
Addition 's runtime take $O(max((log (X), log(Y))$. And, fib(N) requires (N-1) addition. Therefore, the runtime is $O(n^2)$.

iii.)
       [1,{mean,1.48843538064279e-7},{std,2.2447741632663256e-7}]
       [10,{mean,5.613441958954861e-7},{std,5.049726767277179e-7}]
       [100,{mean,5.000896246843316e-6},{std,1.0602028338054286e-6}]
       [1000,{mean,9.33198879245989e-5},{std,5.164703357798524e-6}]
       [10000,{mean,0.00411920796707819},{std,3.453155659057647e-5}]
   [100000,{mean,0.3357487426666667},{std,0.001751090357086825}]

iv.)   fib(0): 0
       fib(1): 1
       fib(2): 1
       fib(3): 2
       fib(5): 5
       fib(10): 55
       fib(100): 354224848179261915075

Q2

Remark: call function hw1:q2a(), hw1:q2b(), hw1:q2c(), hw1:q2d()

2a) O(n). Because the run time is increasing linearly with N.

[[{1}, {mean,1.3350972665434507e-7}, {std,2.122870804594085e-7}],
 [{10}, {mean,2.9967315639660433e-7}, {std,3.820896110133825e-7}],
 [{100}, {mean,2.0120660601015435e-6}, {std,1.320352002851844e-6}],
 [{1000}, {mean,1.9029560171271457e-5}, {std,3.658472604066966e-6}],
 [{10000}, {mean,1.896820838391503e-4}, {std,1.17506352200677182e-5}],
 [{100000}, {mean,0.0018909743780718326}, {std,2.8719542194535035e-5}],
 [{1000000}, {mean,0.019358306730769232}, {std,1.4992730024868957e-4}]]
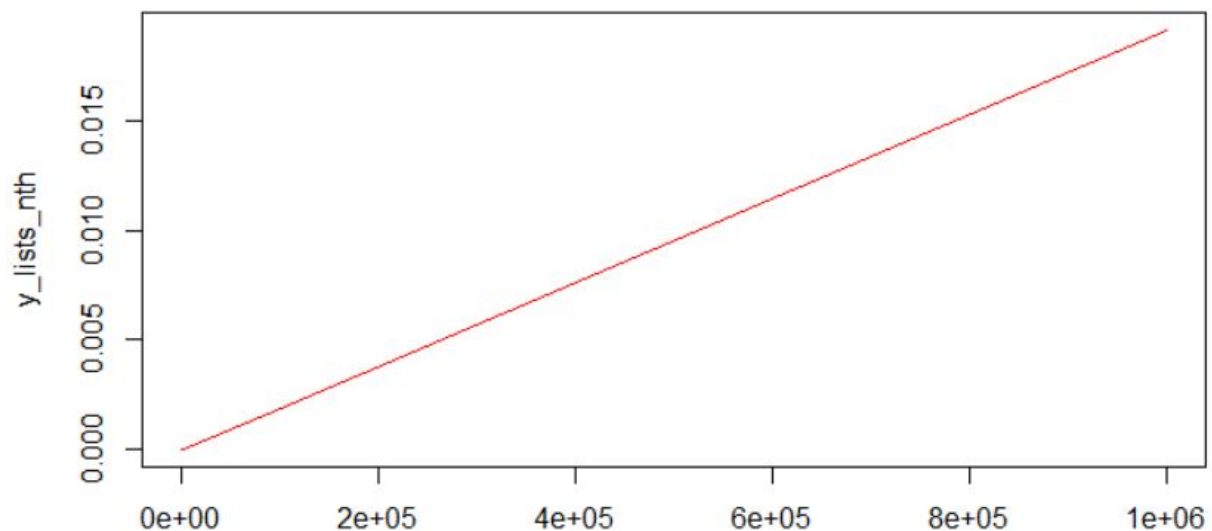

b) O(n). Because the run time is increasing linearly with N.
     [1,{mean,1.4439448640714373e-7},{std,2.2186943899682632e-7}]
     [10,{mean,1.4990654270839861e-7},{std,4.2256787907390975e-7}]
     [100,{mean,3.088687906908137e-7},{std,2.9064467321148986e-7}]
     [1000,{mean,4.365633588286367e-6},{std,1.330044355064522e-6}]
     [10000,{mean,4.0635473628606515e-5},{std,4.482327722330781e-6}]
     [100000,{mean,2.8790381865284923e-4},{std,1.4881507246748477e-5}]
     [1000000,{mean,0.0023683175366430243},{std,5.5302684696191188e-5}]
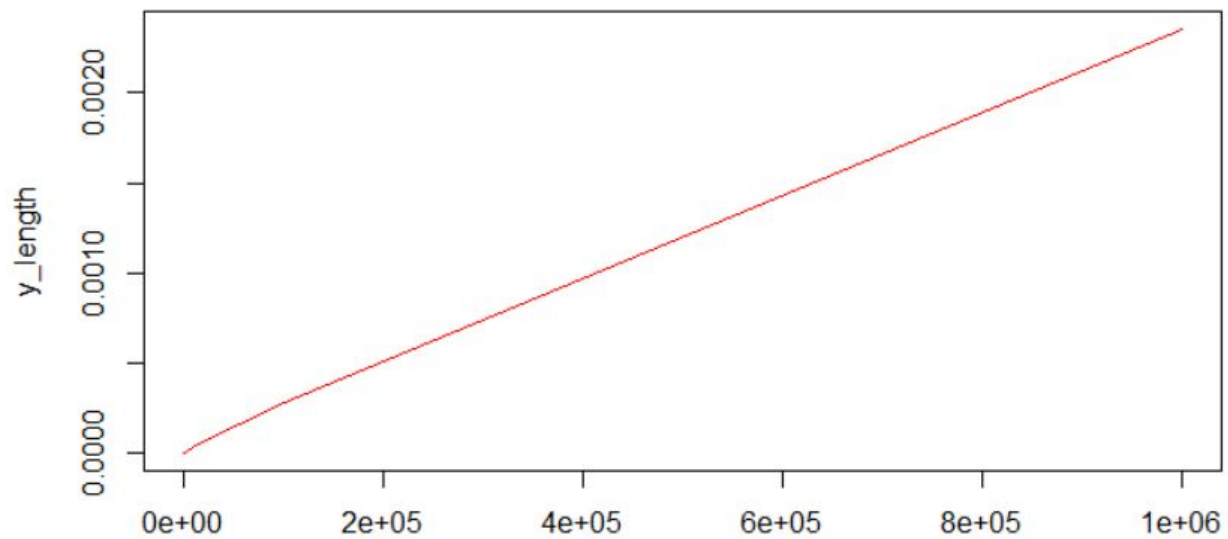
2c) O(1). Because the runtime is almost the same.

[1,{mean,1.2901452923449925e-7},{std,5.449714382009979e-7}]
[10,{mean,1.2694347588545047e-7},{std,2.6794071911587566e-7}]
[100,{mean,1.263598019239983e-7},{std,2.6074035418679015e-7}]
[1000,{mean,1.2505879327088865e-7},{std,1.409091236114146e-7}]
[10000,{mean,1.2510194695467653e-7},{std,1.522703921789194e-7}]
[100000,{mean,1.261937958140304e-7},{std,3.419882121757473e-7}]
[1000000,{mean,1.260448912679361e-7},{std,2.547199136412687e-7}]
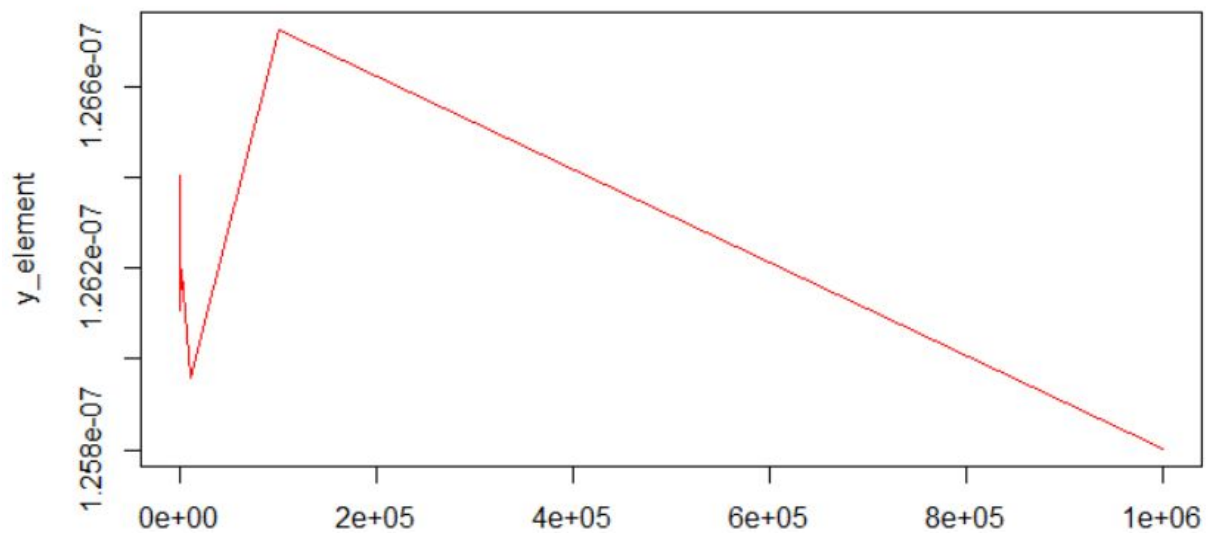
2d). O(n1). The runtime is depend on n1's size.

[{0,0},{mean,1.3874301356287654e-7},{std,2.2092682280753855e-7}]
[{0,10},{mean,1.3703697627481802e-7},{std,2.1501737396700693e-7}]
[{0,100},{mean,1.3735646264946673e-7},{std,5.11875056839734e-7}]
[{0,1000},{mean,1.3669795072105353e-7},{std,2.9484032650330854e-7}]
[{0,10000},{mean,1.3780957997131316e-7},{std,2.4185762729393435e-7}]
[{0,100000},{mean,1.3792313875591257e-7},{std,4.0741860045325414e-7}]
[{0,1000000},{mean,1.387065462278954e-7},{std,2.0234356440378276e-7}]
[{10,0},{mean,1.5682802788824925e-7},{std,2.775545603113997e-7}]
[{10,10},{mean,1.5757116976536246e-7},{std,5.902907029636182e-7}]
[{10,100},{mean,1.5966547976321045e-7},{std,6.978849937218437e-7}]
[{10,1000},{mean,1.5738757364673217e-7},{std,6.881776232511158e-7}]
[{10,10000},{mean,2.0388380621844023e-7},{std,6.161065927002479e-6}]
[{10,100000},{mean,1.5632652744497836e-7},{std,6.181705951124394e-7}]
[{10,1000000},{mean,1.5705439075570579e-7},{std,3.2901495335205e-7}]
[{100,0},{mean,3.9837813892028035e-7},{std,1.9517079104811626e-5}]
[{100,10},{mean,4.408390585057042e-7},{std,4.805214433660773e-6}]
[{100,100},{mean,4.4251281914792463e-7},{std,4.866863846211774e-6}]
[{100,1000},{mean,4.4305967169841755e-7},{std,4.916449303024944e-6}]
[{100,10000},{mean,4.4474127406438563e-7},{std,4.9882687418792255e-6}]
[{100,100000},{mean,4.439619210217656e-7},{std,4.9265050766382965e-6}]
[{100,1000000},{mean,4.417500737689141e-7},{std,4.818987859274549e-6}]
[{1000,0},{mean,5.166744655017233e-6},{std,2.1479695143842986e-6}]
[{1000,10},{mean,5.7337987729708576e-6},{std,7.0344451553681234e-6}]
[{1000,100},{mean,5.723586414523988e-6},{std,6.675935057050845e-6}]
[{1000,1000},{mean,5.739132435736198e-6},{std,6.810251918404799e-6}]
[{1000,10000},{mean,5.736379989215469e-6},{std,6.834976115696124e-6}]
[{1000,100000},{mean,5.736267653301116e-6},{std,6.834925405379825e-6}]
[{1000,1000000},{mean,5.702648901105104e-6},{std,5.651436326861013e-6}]
[{10000,0},{mean,6.818008971911659e-5},{std,8.159904490531935e-6}]
[{10000,10},{mean,7.36852865458294e-5},{std,1.6889482781227963e-4}]
[{10000,100},{mean,7.174004605451895e-5},{std,2.6104084110432624e-5}]
[{10000,1000},{mean,7.166965885472663e-5},{std,2.5853863812044644e-5}]
[{10000,10000},{mean,7.171712112736669e-5},{std,2.6089738089311055e-5}]
[{10000,100000},{mean,7.170201276260143e-5},{std,2.6197097869841094e-5}]
[{10000,1000000},{mean,7.179800014359593e-5},{std,2.6163752322911105e-5}]
[{100000,0},{mean,8.523016030664396e-4},{std,3.4521103980066714e-5}]
[{100000,10},{mean,0.00107495520085929},{std,0.0010718671330711817}]
[{100000,100},{mean,0.0010018330370370372},{std,3.0454310752677937e-4}]
[{100000,1000},{mean,9.620581855769224e-4},{std,3.022972484590065e-4}]
[{100000,10000},{mean,9.729667801556425e-4},{std,3.0427195170871737e-4}]
[{100000,100000},{mean,9.643754619093549e-4},{std,3.015240541951859e-4}]

[{100000,1000000},{mean,9.656009932432439e-4},{std,3.138524235825686e-4}]
[{1000000,0},{mean,0.005061628499999998},{std,1.469280654041385e-4}]
[{1000000,10},{mean,0.012101719440476187},{std,0.0062616725954900525}]
[{1000000,100},{mean,0.011791059611764706},{std,0.0059502585285043045}]
[{1000000,1000},{mean,0.012245927349397594},{std,0.0064998456564241405}]
[{1000000,10000},{mean,0.012579665271604935},{std,0.006445092966599297}]
[{1000000,100000},{mean,0.012057279357142861},{std,0.006138180575828522}]
[{1000000,1000000},{mean,0.012020456107142858},{std,0.006155874304170561}]