

NTTRU_Estimation

April 12, 2024

1 NTTRU Estimation

Estimate the drop of bit security caused by multiple information leaked from power side channel.

```
[4]: load("../framework/instance_gen.sage")
```

```
[ ]: ## NTRU instance initialization

n = 768
m = n
q = 7681

# D_e = {-1: 5/16, 0:6/16, 1:5/16}
# D_s = D_e
# number of one in f and g In NTTRU , the distribution of -1,0,1 is 5/16, 6/
↪16,6/16
Dg = int(round(6*n/16))
Df = Dg
bit_security_constant = 0.292

A, b, dbdd = initialize_NTRU_instance(DBDD, n, q, Df, Dg, verbosity=0)
# A, b, dbdd = initialize_from_LWE_instance(DBDD_predict, n, q, m, D_e, D_s)
```

hello

```
[17]: ## example s_hat
```

```
s_hat = [4516, 2276, 4914, 5522, 2472, 5117, 7189, 4818, 5814, 1201, 1768,↵
↵7572, 3018, 5671, 2316, 996, 6907, 6410, 2334, 3437, 7231, 4926, 6416, 1720,↵
↵7430, 2082, 1105, 2672, 1596, 3064, 2279, 6081, 695, 5503, 3467, 5420, 3861,↵
↵5016, 2590, 6879, 3688, 4971, 3467, 7062, 3762, 3535, 7002, 559, 440, 6840,↵
↵7548, 4458, 4500, 5452, 6788, 7424, 4462, 1650, 4791, 7390, 2845, 6256,↵
↵6006, 3723, 7136, 6350, 1561, 6260, 3051, 86, 5942, 721, 6415, 5482, 868,↵
↵2459, 1561, 3848, 7522, 6214, 2874, 6307, 3801, 16, 4851, 5708, 5874, 688,↵
↵1082, 6398, 5252, 3344, 5333, 4710, 900, 4981, 7255, 6223, 1488, 5212, 5951,↵
↵1789, 7208, 1478, 6567, 3085, 7176, 834, 102, 5594, 1980, 6670, 4149, 1332,↵
↵4888, 2318, 2330, 4196, 3930, 3250, 4589, 108, 2761, 6388, 6578, 2312, 1610,↵
↵30, 1348, 6887, 786, 4489, 4604, 2754, 3360, 4780, 188, 904, 428, 6826, 148,↵
↵943, 7320, 7451, 4167, 4161, 2832, 5735, 7086, 7393, 2624, 1840, 7478, 4592,↵
↵280, 464, 6395, 5864, 3626, 2199, 3651, 3268, 6670, 3312, 1430, 5538, 5984,↵
↵6753, 4129, 727, 4918, 5661, 6042, 2498, 4212, 1973, 2079, 4977, 2387, 4547,↵
↵7605, 163, 6628, 6136, 2867, 1456, 769, 4996, 686, 1200, 4761, 1931, 477,↵
↵5468, 894, 5169, 5875, 3919, 4983, 363, 128, 2287, 4073, 2398, 4901, 4766,↵
↵5572, 6981, 5990, 4181, 6995, 893, 5123, 3268, 4434, 3012, 1704, 712, 537,↵
↵1003, 2100, 7539, 4758, 1817, 7385, 612, 6885, 2377, 5414, 3853, 6143, 3117,↵
↵1638, 4684, 607, 4627, 745, 4854, 4869, 183, 586, 1276, 3051, 4086, 4343,↵
↵2905, 1035, 3329, 1936, 5084, 272, 4985, 31, 253, 4550, 907, 1079, 546,↵
↵5452, 6725, 673, 2905, 1424, 1601, 6047, 2994, 6777, 2771, 1097, 323, 2046,↵
↵7311, 2540, 7169, 682, 6265, 6599, 3487, 6608, 5150, 7447, 4125, 1270, 2353,↵
↵4342, 6965, 4290, 1010, 4200, 3542, 3453, 4575, 3976, 6033, 741, 4041, 6034,↵
↵2553, 4441, 3423, 4379, 7370, 2147, 4243, 5072, 94, 42, 4717, 2101, 3, 6901,↵
↵1147, 3461, 3229, 1776, 6254, 4576, 7095, 7408, 4630, 3151, 5063, 3518,↵
↵1765, 764, 341, 6200, 5867, 3430, 7555, 3497, 7305, 5325, 5274, 5679, 472,↵
↵1501, 5398, 3589, 6722, 7130, 6049, 2782, 5222, 723, 7464, 38, 4328, 6008,↵
↵6458, 6082, 3102, 3766, 3205, 5245, 5224, 3691, 2179, 2279, 4945, 1991,↵
↵6899, 3898, 509, 870, 3606, 4113, 6816, 3293, 3006, 7097, 5440, 2275, 4172,↵
↵2874, 7586, 583, 2204, 6288, 2087, 6755, 6593, 6592, 588, 189, 7161, 58,↵
↵6828, 1545, 7128, 4916, 132, 3461, 2197, 1, 6035, 4164, 636, 2939, 7607,↵
↵4329, 6173, 1323, 2827, 7285, 4506, 6167, 2331, 3906, 5741, 849, 5454, 6157,↵
↵638, 4616, 7358, 3754, 3646, 1220, 251, 6155, 2733, 6515, 5262, 6387, 6227,↵
↵3970, 2237, 3621, 2783, 183, 1341, 4858, 7483, 3590, 2305, 6997, 1967, 6664,↵
↵6463, 2526, 6922, 3706, 4610, 181, 7429, 5752, 2595, 2311, 6751, 5, 1630,↵
↵6141, 4774, 3375, 3663, 4277, 447, 1889, 6765, 3660, 5139, 3795, 6880, 317,↵
↵5023, 1390, 1337, 4462, 4676, 5781, 725, 2274, 3471, 5600, 2916, 6024, 4213,↵
↵2895, 5809, 1809, 3599, 6473, 321, 6570, 6988, 3231, 3814, 4947, 4722, 7232,↵
↵176, 5668, 3001, 2782, 6479, 6300, 2904, 585, 3376, 4931, 3312, 2139, 6065,↵
↵5423, 7122, 4999, 67, 1833, 1862, 7387, 1758, 2282, 1978, 4079, 784, 4515,↵
↵7292, 6006, 923, 5078, 5860, 6711, 3596, 5897, 168, 2935, 3140, 6282, 1184,↵
```

[19]: *## NTT initialization*

```
bit_reverse_tree = [1, 128, 64, 320, 32, 224, 160, 352, 16, 208, 112, 304, 80, ↵
↵ 272, 176, 368, 8, 200, 104, 296, 56, 248, 152, 344, 40, 232, 136, 328, 88, ↵
↵ 280, 184, 376, 4, 196, 100, 292, 52, 244, 148, 340, 28, 220, 124, 316, 76, ↵
↵ 268, 172, 364, 20, 212, 116, 308, 68, 260, 164, 356, 44, 236, 140, 332, 92, ↵
↵ 284, 188, 380, 2, 194, 98, 290, 50, 242, 146, 338, 26, 218, 122, 314, 74, ↵
↵ 266, 170, 362, 14, 206, 110, 302, 62, 254, 158, 350, 38, 230, 134, 326, 86, ↵
↵ 278, 182, 374, 10, 202, 106, 298, 58, 250, 154, 346, 34, 226, 130, 322, 82, ↵
↵ 274, 178, 370, 22, 214, 118, 310, 70, 262, 166, 358, 46, 238, 142, 334, 94, ↵
↵ 286, 190, 382, 1, 193, 97, 289, 49, 241, 145, 337, 25, 217, 121, 313, 73, ↵
↵ 265, 169, 361, 13, 205, 109, 301, 61, 253, 157, 349, 37, 229, 133, 325, 85, ↵
↵ 277, 181, 373, 7, 199, 103, 295, 55, 247, 151, 343, 31, 223, 127, 319, 79, ↵
↵ 271, 175, 367, 19, 211, 115, 307, 67, 259, 163, 355, 43, 235, 139, 331, 91, ↵
↵ 283, 187, 379, 5, 197, 101, 293, 53, 245, 149, 341, 29, 221, 125, 317, 77, ↵
↵ 269, 173, 365, 17, 209, 113, 305, 65, 257, 161, 353, 41, 233, 137, 329, 89, ↵
↵ 281, 185, 377, 11, 203, 107, 299, 59, 251, 155, 347, 35, 227, 131, 323, 83, ↵
↵ 275, 179, 371, 23, 215, 119, 311, 71, 263, 167, 359, 47, 239, 143, 335, 95, ↵
↵ 287, 191, 383]

R = IntegerModRing(q)
V = VectorSpace(R,n)

import numpy as np

# def bit_reverse(x):return int( "0b" + bin(x)[2:].rjust(8,'0')[:-1] ,2)+1
def bit_reverse(x): return bit_reverse_tree[x]
NTT_matrix = []

def add (x,y) : return x +y

for x in range(n/3):
    NTT_matrix.append(V(reduce(add, [[20^(x*bit_reverse(i)),0,0] for i in ↵
↵ range(n/3)])))
    NTT_matrix.append(V(reduce(add, [[0,20^(x*bit_reverse(i)),0] for i in ↵
↵ range(n/3)])))
    NTT_matrix.append(V(reduce(add, [[0,0,20^(x*bit_reverse(i))] for i in ↵
↵ range(n/3)])))

NTT_matrix = matrix(NTT_matrix)

# inv_NTT_matrix = NTT_matrix^-1
```

[20]: dbdd.leak?

Signature: . ()
Init docstring:

File:

Type:

```
[46]: zeta = 20
from tqdm import trange

def enumerate_z(tripple_indexes):

    curr_zeta = R(zeta**bit_reverse_tree[tripple_indexes])
    f_hat_0= s_hat[tripple_indexes*3]
    f_hat_1= s_hat[tripple_indexes*3+1]
    f_hat_2= s_hat[tripple_indexes*3+2]

    for z in trange(q):
        for z_prime in range(q):
            if (z*f_hat_0+f_hat_1+z_prime*f_hat_2*curr_zeta==0 and
↪z_prime*f_hat_0 + z*f_hat_1 +f_hat_2==0):
                return (z,z_prime)

    print("flase")
    return 0,0
f_hat_0= s_hat[0]
f_hat_1= s_hat[1]
f_hat_2= s_hat[2]

0*f_hat_0+f_hat_1+0*f_hat_2*20==0
# enumerate_z(0)
```

[46]: 2276

```
[32]: v_list = []
index_s = 0
zeta = R(20)

s_relation = [R(-1*s_hat[3*i+1]-s_hat[3*i+2])/R(s_hat[3*i]) for i in range(n/3)]

for i in range(n/3):
    k = s_relation[i]
    v = list((NTT_matrix[3*i+2] + NTT_matrix[3*i+1]+ k *NTT_matrix[3*i]))
    # v = [0]*int(256*index_s) + v + [0]*int(256*(KYBER_N-index_s-1))
    v_prime = [int(i) for i in list(v)] + [0]*768

    v_prime= vec(v_prime)
```

```

v_list.append(v_prime)

v = list((NTT_matrix[3*i+2]*k + NTT_matrix[3*i+1]+ *NTT_matrix[3*i]))
# v = [0]*int(256*index_s) + v + [0]*int(256*(KYBER_N-index_s-1))
v_prime = [int(i) for i in list(v)] + [0]*768

v_prime= vec(v_prime)
v_list.append(v_prime)

dbdd.leak(v_prime)

```

```
[ ]: dbdd.integrate_modular_hint?
```

```
[23]: for v_prime in v_list:
        dbdd.integrate_modular_hint(v_prime,0,3329,True)
```

integrate modular hint	Worthy hint !
dim=1537, =1.00327435, =527.95	
integrate modular hint	Worthy hint !
dim=1537, =1.00327779, =527.27	
integrate modular hint	Worthy hint !
dim=1537, =1.00328063, =526.59	
integrate modular hint	Worthy hint !
dim=1537, =1.00328348, =525.91	
integrate modular hint	Worthy hint !
dim=1537, =1.00328692, =525.23	
integrate modular hint	Worthy hint !
dim=1537, =1.00328976, =524.55	
integrate modular hint	Worthy hint !
dim=1537, =1.00329260, =523.88	
integrate modular hint	Worthy hint !
dim=1537, =1.00329605, =523.20	
integrate modular hint	Worthy hint !
dim=1537, =1.00329889, =522.53	
integrate modular hint	Worthy hint !
dim=1537, =1.00330173, =521.86	
integrate modular hint	Worthy hint !
dim=1537, =1.00330517, =521.19	

integrate modular hint	Worthy hint !
dim=1537, =1.00330801, =520.52	
integrate modular hint	Worthy hint !
dim=1537, =1.00331084, =519.85	
integrate modular hint	Worthy hint !
dim=1537, =1.00331429, =519.18	
integrate modular hint	Worthy hint !
dim=1537, =1.00331712, =518.52	
integrate modular hint	Worthy hint !
dim=1537, =1.00331996, =517.86	
integrate modular hint	Worthy hint !
dim=1537, =1.00332340, =517.19	
integrate modular hint	Worthy hint !
dim=1537, =1.00332623, =516.53	
integrate modular hint	Worthy hint !
dim=1537, =1.00332906, =515.87	
integrate modular hint	Worthy hint !
dim=1537, =1.00333251, =515.21	
integrate modular hint	Worthy hint !
dim=1537, =1.00333534, =514.56	
integrate modular hint	Worthy hint !
dim=1537, =1.00333817, =513.90	
integrate modular hint	Worthy hint !
dim=1537, =1.00334161, =513.25	
integrate modular hint	Worthy hint !
dim=1537, =1.00334444, =512.59	
integrate modular hint	Worthy hint !
dim=1537, =1.00334727, =511.94	
integrate modular hint	Worthy hint !
dim=1537, =1.00335071, =511.29	
integrate modular hint	Worthy hint !
dim=1537, =1.00335354, =510.64	
integrate modular hint	Worthy hint !
dim=1537, =1.00335636, =509.99	
integrate modular hint	Worthy hint !
dim=1537, =1.00335981, =509.34	

integrate modular hint	Worthy hint !
dim=1537, =1.00336263, =508.70	
integrate modular hint	Worthy hint !
dim=1537, =1.00336607, =508.05	
integrate modular hint	Worthy hint !
dim=1537, =1.00336890, =507.41	
integrate modular hint	Worthy hint !
dim=1537, =1.00337172, =506.77	
integrate modular hint	Worthy hint !
dim=1537, =1.00337516, =506.13	
integrate modular hint	Worthy hint !
dim=1537, =1.00337798, =505.49	
integrate modular hint	Worthy hint !
dim=1537, =1.00338080, =504.85	
integrate modular hint	Worthy hint !
dim=1537, =1.00338424, =504.21	
integrate modular hint	Worthy hint !
dim=1537, =1.00338706, =503.58	
integrate modular hint	Worthy hint !
dim=1537, =1.00338988, =502.94	
integrate modular hint	Worthy hint !
dim=1537, =1.00339332, =502.31	
integrate modular hint	Worthy hint !
dim=1537, =1.00339614, =501.67	
integrate modular hint	Worthy hint !
dim=1537, =1.00339958, =501.04	
integrate modular hint	Worthy hint !
dim=1537, =1.00340240, =500.41	
integrate modular hint	Worthy hint !
dim=1537, =1.00340521, =499.78	
integrate modular hint	Worthy hint !
dim=1537, =1.00340865, =499.16	
integrate modular hint	Worthy hint !
dim=1537, =1.00341146, =498.53	
integrate modular hint	Worthy hint !
dim=1537, =1.00341427, =497.91	

integrate modular hint	Worthy hint !
dim=1537, =1.00341772, =497.28	
integrate modular hint	Worthy hint !
dim=1537, =1.00342053, =496.66	
integrate modular hint	Worthy hint !
dim=1537, =1.00342397, =496.04	
integrate modular hint	Worthy hint !
dim=1537, =1.00342678, =495.42	
integrate modular hint	Worthy hint !
dim=1537, =1.00342959, =494.80	
integrate modular hint	Worthy hint !
dim=1537, =1.00343303, =494.18	
integrate modular hint	Worthy hint !
dim=1537, =1.00343584, =493.56	
integrate modular hint	Worthy hint !
dim=1537, =1.00343864, =492.95	
integrate modular hint	Worthy hint !
dim=1537, =1.00344209, =492.33	
integrate modular hint	Worthy hint !
dim=1537, =1.00344489, =491.72	
integrate modular hint	Worthy hint !
dim=1537, =1.00344833, =491.11	
integrate modular hint	Worthy hint !
dim=1537, =1.00345113, =490.50	
integrate modular hint	Worthy hint !
dim=1537, =1.00345393, =489.89	
integrate modular hint	Worthy hint !
dim=1537, =1.00345738, =489.28	
integrate modular hint	Worthy hint !
dim=1537, =1.00346018, =488.67	
integrate modular hint	Worthy hint !
dim=1537, =1.00346362, =488.07	
integrate modular hint	Worthy hint !
dim=1537, =1.00346642, =487.46	
integrate modular hint	Worthy hint !
dim=1537, =1.00346922, =486.86	

integrate modular hint	Worthy hint !
dim=1537, =1.00347266, =486.25	
integrate modular hint	Worthy hint !
dim=1537, =1.00347546, =485.65	
integrate modular hint	Worthy hint !
dim=1537, =1.00347890, =485.05	
integrate modular hint	Worthy hint !
dim=1537, =1.00348169, =484.45	
integrate modular hint	Worthy hint !
dim=1537, =1.00348449, =483.85	
integrate modular hint	Worthy hint !
dim=1537, =1.00348793, =483.26	
integrate modular hint	Worthy hint !
dim=1537, =1.00349072, =482.66	
integrate modular hint	Worthy hint !
dim=1537, =1.00349417, =482.06	
integrate modular hint	Worthy hint !
dim=1537, =1.00349696, =481.47	
integrate modular hint	Worthy hint !
dim=1537, =1.00349975, =480.88	
integrate modular hint	Worthy hint !
dim=1537, =1.00350319, =480.29	
integrate modular hint	Worthy hint !
dim=1537, =1.00350598, =479.70	
integrate modular hint	Worthy hint !
dim=1537, =1.00350942, =479.11	
integrate modular hint	Worthy hint !
dim=1537, =1.00351221, =478.52	
integrate modular hint	Worthy hint !
dim=1537, =1.00351499, =477.93	
integrate modular hint	Worthy hint !
dim=1537, =1.00351844, =477.34	
integrate modular hint	Worthy hint !
dim=1537, =1.00352122, =476.76	
integrate modular hint	Worthy hint !
dim=1537, =1.00352467, =476.18	

integrate modular hint	Worthy hint !
dim=1537, =1.00352745, =475.59	
integrate modular hint	Worthy hint !
dim=1537, =1.00353089, =475.01	
integrate modular hint	Worthy hint !
dim=1537, =1.00353367, =474.43	
integrate modular hint	Worthy hint !
dim=1537, =1.00353645, =473.85	
integrate modular hint	Worthy hint !
dim=1537, =1.00353990, =473.27	
integrate modular hint	Worthy hint !
dim=1537, =1.00354268, =472.69	
integrate modular hint	Worthy hint !
dim=1537, =1.00354612, =472.12	
integrate modular hint	Worthy hint !
dim=1537, =1.00354890, =471.54	
integrate modular hint	Worthy hint !
dim=1537, =1.00355167, =470.97	
integrate modular hint	Worthy hint !
dim=1537, =1.00355512, =470.40	
integrate modular hint	Worthy hint !
dim=1537, =1.00355789, =469.82	
integrate modular hint	Worthy hint !
dim=1537, =1.00356134, =469.25	
integrate modular hint	Worthy hint !
dim=1537, =1.00356411, =468.68	
integrate modular hint	Worthy hint !
dim=1537, =1.00356756, =468.11	
integrate modular hint	Worthy hint !
dim=1537, =1.00357033, =467.55	
integrate modular hint	Worthy hint !
dim=1537, =1.00357310, =466.98	
integrate modular hint	Worthy hint !
dim=1537, =1.00357654, =466.41	
integrate modular hint	Worthy hint !
dim=1537, =1.00357931, =465.85	

integrate modular hint	Worthy hint !
dim=1537, =1.00358275, =465.28	
integrate modular hint	Worthy hint !
dim=1537, =1.00358552, =464.72	
integrate modular hint	Worthy hint !
dim=1537, =1.00358897, =464.16	
integrate modular hint	Worthy hint !
dim=1537, =1.00359173, =463.60	
integrate modular hint	Worthy hint !
dim=1537, =1.00359518, =463.04	
integrate modular hint	Worthy hint !
dim=1537, =1.00359794, =462.48	
integrate modular hint	Worthy hint !
dim=1537, =1.00360070, =461.92	
integrate modular hint	Worthy hint !
dim=1537, =1.00360415, =461.37	
integrate modular hint	Worthy hint !
dim=1537, =1.00360691, =460.81	
integrate modular hint	Worthy hint !
dim=1537, =1.00361036, =460.26	
integrate modular hint	Worthy hint !
dim=1537, =1.00361312, =459.70	
integrate modular hint	Worthy hint !
dim=1537, =1.00361656, =459.15	
integrate modular hint	Worthy hint !
dim=1537, =1.00361932, =458.60	
integrate modular hint	Worthy hint !
dim=1537, =1.00362276, =458.05	
integrate modular hint	Worthy hint !
dim=1537, =1.00362552, =457.50	
integrate modular hint	Worthy hint !
dim=1537, =1.00362828, =456.95	
integrate modular hint	Worthy hint !
dim=1537, =1.00363172, =456.40	
integrate modular hint	Worthy hint !
dim=1537, =1.00363448, =455.86	

integrate modular hint	Worthy hint !
dim=1537, =1.00363792, =455.31	
integrate modular hint	Worthy hint !
dim=1537, =1.00364067, =454.77	
integrate modular hint	Worthy hint !
dim=1537, =1.00364412, =454.22	
integrate modular hint	Worthy hint !
dim=1537, =1.00364687, =453.68	
integrate modular hint	Worthy hint !
dim=1537, =1.00365032, =453.14	
integrate modular hint	Worthy hint !
dim=1537, =1.00365307, =452.60	
integrate modular hint	Worthy hint !
dim=1537, =1.00365651, =452.06	
integrate modular hint	Worthy hint !
dim=1537, =1.00365926, =451.52	
integrate modular hint	Worthy hint !
dim=1537, =1.00366201, =450.98	
integrate modular hint	Worthy hint !
dim=1537, =1.00366545, =450.45	
integrate modular hint	Worthy hint !
dim=1537, =1.00366820, =449.91	
integrate modular hint	Worthy hint !
dim=1537, =1.00367164, =449.37	
integrate modular hint	Worthy hint !
dim=1537, =1.00367438, =448.84	
integrate modular hint	Worthy hint !
dim=1537, =1.00367783, =448.31	
integrate modular hint	Worthy hint !
dim=1537, =1.00368057, =447.78	
integrate modular hint	Worthy hint !
dim=1537, =1.00368402, =447.25	
integrate modular hint	Worthy hint !
dim=1537, =1.00368676, =446.72	
integrate modular hint	Worthy hint !
dim=1537, =1.00369020, =446.19	

integrate modular hint	Worthy hint !
dim=1537, =1.00369294, =445.66	
integrate modular hint	Worthy hint !
dim=1537, =1.00369639, =445.13	
integrate modular hint	Worthy hint !
dim=1537, =1.00369913, =444.61	
integrate modular hint	Worthy hint !
dim=1537, =1.00370257, =444.08	
integrate modular hint	Worthy hint !
dim=1537, =1.00370531, =443.56	
integrate modular hint	Worthy hint !
dim=1537, =1.00370875, =443.03	
integrate modular hint	Worthy hint !
dim=1537, =1.00371149, =442.51	
integrate modular hint	Worthy hint !
dim=1537, =1.00371422, =441.99	
integrate modular hint	Worthy hint !
dim=1537, =1.00371767, =441.47	
integrate modular hint	Worthy hint !
dim=1537, =1.00372040, =440.95	
integrate modular hint	Worthy hint !
dim=1537, =1.00372384, =440.43	
integrate modular hint	Worthy hint !
dim=1537, =1.00372657, =439.91	
integrate modular hint	Worthy hint !
dim=1537, =1.00373002, =439.39	
integrate modular hint	Worthy hint !
dim=1537, =1.00373275, =438.88	
integrate modular hint	Worthy hint !
dim=1537, =1.00373619, =438.36	
integrate modular hint	Worthy hint !
dim=1537, =1.00373892, =437.85	
integrate modular hint	Worthy hint !
dim=1537, =1.00374237, =437.34	
integrate modular hint	Worthy hint !
dim=1537, =1.00374509, =436.82	

integrate modular hint	Worthy hint !
dim=1537, =1.00374854, =436.31	
integrate modular hint	Worthy hint !
dim=1537, =1.00375126, =435.80	
integrate modular hint	Worthy hint !
dim=1537, =1.00375471, =435.29	
integrate modular hint	Worthy hint !
dim=1537, =1.00375743, =434.78	
integrate modular hint	Worthy hint !
dim=1537, =1.00376087, =434.28	
integrate modular hint	Worthy hint !
dim=1537, =1.00376359, =433.77	
integrate modular hint	Worthy hint !
dim=1537, =1.00376704, =433.26	
integrate modular hint	Worthy hint !
dim=1537, =1.00376976, =432.76	
integrate modular hint	Worthy hint !
dim=1537, =1.00377320, =432.25	
integrate modular hint	Worthy hint !
dim=1537, =1.00377592, =431.75	
integrate modular hint	Worthy hint !
dim=1537, =1.00377937, =431.25	
integrate modular hint	Worthy hint !
dim=1537, =1.00378208, =430.75	
integrate modular hint	Worthy hint !
dim=1537, =1.00378553, =430.25	
integrate modular hint	Worthy hint !
dim=1537, =1.00378824, =429.75	
integrate modular hint	Worthy hint !
dim=1537, =1.00379169, =429.25	
integrate modular hint	Worthy hint !
dim=1537, =1.00379440, =428.75	
integrate modular hint	Worthy hint !
dim=1537, =1.00379785, =428.25	
integrate modular hint	Worthy hint !
dim=1537, =1.00380056, =427.76	

integrate modular hint	Worthy hint !
dim=1537, =1.00380400, =427.26	
integrate modular hint	Worthy hint !
dim=1537, =1.00380671, =426.77	
integrate modular hint	Worthy hint !
dim=1537, =1.00381016, =426.27	
integrate modular hint	Worthy hint !
dim=1537, =1.00381286, =425.78	
integrate modular hint	Worthy hint !
dim=1537, =1.00381631, =425.29	
integrate modular hint	Worthy hint !
dim=1537, =1.00381902, =424.80	
integrate modular hint	Worthy hint !
dim=1537, =1.00382246, =424.31	
integrate modular hint	Worthy hint !
dim=1537, =1.00382517, =423.82	
integrate modular hint	Worthy hint !
dim=1537, =1.00382861, =423.33	
integrate modular hint	Worthy hint !
dim=1537, =1.00383131, =422.84	
integrate modular hint	Worthy hint !
dim=1537, =1.00383476, =422.35	
integrate modular hint	Worthy hint !
dim=1537, =1.00383746, =421.87	
integrate modular hint	Worthy hint !
dim=1537, =1.00384091, =421.38	
integrate modular hint	Worthy hint !
dim=1537, =1.00384361, =420.90	
integrate modular hint	Worthy hint !
dim=1537, =1.00384705, =420.41	
integrate modular hint	Worthy hint !
dim=1537, =1.00384975, =419.93	
integrate modular hint	Worthy hint !
dim=1537, =1.00385320, =419.45	
integrate modular hint	Worthy hint !
dim=1537, =1.00385589, =418.97	

integrate modular hint	Worthy hint !
dim=1537, =1.00385934, =418.49	
integrate modular hint	Worthy hint !
dim=1537, =1.00386278, =418.01	
integrate modular hint	Worthy hint !
dim=1537, =1.00386548, =417.53	
integrate modular hint	Worthy hint !
dim=1537, =1.00386892, =417.05	
integrate modular hint	Worthy hint !
dim=1537, =1.00387161, =416.58	
integrate modular hint	Worthy hint !
dim=1537, =1.00387506, =416.10	
integrate modular hint	Worthy hint !
dim=1537, =1.00387775, =415.62	
integrate modular hint	Worthy hint !
dim=1537, =1.00388120, =415.15	
integrate modular hint	Worthy hint !
dim=1537, =1.00388389, =414.68	
integrate modular hint	Worthy hint !
dim=1537, =1.00388733, =414.20	
integrate modular hint	Worthy hint !
dim=1537, =1.00389002, =413.73	
integrate modular hint	Worthy hint !
dim=1537, =1.00389347, =413.26	
integrate modular hint	Worthy hint !
dim=1537, =1.00389615, =412.79	
integrate modular hint	Worthy hint !
dim=1537, =1.00389960, =412.32	
integrate modular hint	Worthy hint !
dim=1537, =1.00390228, =411.85	
integrate modular hint	Worthy hint !
dim=1537, =1.00390573, =411.38	
integrate modular hint	Worthy hint !
dim=1537, =1.00390841, =410.92	
integrate modular hint	Worthy hint !
dim=1537, =1.00391185, =410.45	

integrate modular hint	Worthy hint !
dim=1537, =1.00391453, =409.98	
integrate modular hint	Worthy hint !
dim=1537, =1.00391798, =409.52	
integrate modular hint	Worthy hint !
dim=1537, =1.00392143, =409.06	
integrate modular hint	Worthy hint !
dim=1537, =1.00392410, =408.59	
integrate modular hint	Worthy hint !
dim=1537, =1.00392755, =408.13	
integrate modular hint	Worthy hint !
dim=1537, =1.00393023, =407.67	
integrate modular hint	Worthy hint !
dim=1537, =1.00393367, =407.21	
integrate modular hint	Worthy hint !
dim=1537, =1.00393635, =406.75	
integrate modular hint	Worthy hint !
dim=1537, =1.00393979, =406.29	
integrate modular hint	Worthy hint !
dim=1537, =1.00394246, =405.83	
integrate modular hint	Worthy hint !
dim=1537, =1.00394591, =405.37	
integrate modular hint	Worthy hint !
dim=1537, =1.00394858, =404.92	
integrate modular hint	Worthy hint !
dim=1537, =1.00395203, =404.46	
integrate modular hint	Worthy hint !
dim=1537, =1.00395548, =404.00	
integrate modular hint	Worthy hint !
dim=1537, =1.00395814, =403.55	
integrate modular hint	Worthy hint !
dim=1537, =1.00396159, =403.10	
integrate modular hint	Worthy hint !
dim=1537, =1.00396426, =402.64	
integrate modular hint	Worthy hint !
dim=1537, =1.00396770, =402.19	

integrate modular hint	Worthy hint !
dim=1537, =1.00397037, =401.74	
integrate modular hint	Worthy hint !
dim=1537, =1.00397381, =401.29	
integrate modular hint	Worthy hint !
dim=1537, =1.00397648, =400.84	
integrate modular hint	Worthy hint !
dim=1537, =1.00397992, =400.39	
integrate modular hint	Worthy hint !
dim=1537, =1.00398259, =399.94	
integrate modular hint	Worthy hint !
dim=1537, =1.00398603, =399.49	
integrate modular hint	Worthy hint !
dim=1537, =1.00398948, =399.05	
integrate modular hint	Worthy hint !
dim=1537, =1.00399214, =398.60	
integrate modular hint	Worthy hint !
dim=1537, =1.00399558, =398.15	
integrate modular hint	Worthy hint !
dim=1537, =1.00399824, =397.71	
integrate modular hint	Worthy hint !
dim=1537, =1.00400169, =397.27	
integrate modular hint	Worthy hint !
dim=1537, =1.00400434, =396.82	
integrate modular hint	Worthy hint !
dim=1537, =1.00400779, =396.38	
integrate modular hint	Worthy hint !
dim=1537, =1.00401044, =395.94	
integrate modular hint	Worthy hint !
dim=1537, =1.00401389, =395.50	
integrate modular hint	Worthy hint !
dim=1537, =1.00401734, =395.06	
integrate modular hint	Worthy hint !
dim=1537, =1.00401999, =394.62	
integrate modular hint	Worthy hint !
dim=1537, =1.00402344, =394.18	

<code>integrate modular hint</code>	Worthy hint !
<code>dim=1537, =1.00402609, =393.74</code>	
<code>integrate modular hint</code>	Worthy hint !
<code>dim=1537, =1.00402953, =393.30</code>	
<code>integrate modular hint</code>	Worthy hint !
<code>dim=1537, =1.00403218, =392.87</code>	
<code>integrate modular hint</code>	Worthy hint !
<code>dim=1537, =1.00403563, =392.43</code>	
<code>integrate modular hint</code>	Worthy hint !
<code>dim=1537, =1.00403827, =391.99</code>	
<code>integrate modular hint</code>	Worthy hint !
<code>dim=1537, =1.00404172, =391.56</code>	
<code>integrate modular hint</code>	Worthy hint !
<code>dim=1537, =1.00404517, =391.13</code>	
<code>integrate modular hint</code>	Worthy hint !
<code>dim=1537, =1.00404781, =390.69</code>	
<code>integrate modular hint</code>	Worthy hint !
<code>dim=1537, =1.00405126, =390.26</code>	
<code>integrate modular hint</code>	Worthy hint !
<code>dim=1537, =1.00405390, =389.83</code>	
<code>integrate modular hint</code>	Worthy hint !
<code>dim=1537, =1.00405735, =389.40</code>	

[47]: 0.292*527

[47]: 153.884000000000

[28]: 0.292*389.40

[28]: 113.704800000000