Smashing SMASH

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Abstract. We present a collision attack on SMASH. The attack uses negligible resources and we conjecture that it works for all hash functions built following the design method of SMASH.
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1 Introduction

The hash function SMASH was presented as an example of a new design strategy for hash functions, different from the MD4-strategy [2]. We present here an attack that works independently of the choice that is made for the nonlinear bijective map in the hash function.

The attack is based on an extension of the *forward prediction property* already observed in the design document. Furthermore, we exploit the absence of a secret key to construct differentials with probability 1.

We briefly recall the most important aspects of SMASH in Section 2. In Section 3, we introduce the underlying principles of the attack and apply it to a simplified variant of SMASH. In Section 4, we extend the attack to cover SMASH-256 and SMASH-512. We conclude in Section 5.

2 SMASH

We present here a quick overview of the hash function design strategy presented in [2], and the specific instance SMASH-256. We follow the notation of [2], except that we denote finite field addition by '+', and we stick to the convention of [1] to denote a difference by $h' = h + h^*$.

Knudsen proposes a new hash function model based on a bijective n-bit mapping f. Let $m = m_1, m_2, \ldots, m_t$ be the message input, where each block m_i is of n bits. The hash output h_{t+1} is computed as follows:

$$h_0 = f(\mathrm{iv}) + \mathrm{iv} \tag{1}$$
$$h_i = f(h_{i-1} + m_i) + h_{i-1} + \theta m_i \qquad \text{for } i = 1, \ldots, t \tag{2}$$
$$h_{t+1} = f(h_t) + h_t \ . \tag{3}$$

The properties of f are not relevant for our attack, hence we don't repeat them here. Multiplication by θ is defined as an operation in the finite field $\mathrm{GF}(2^n)$.

This structure exhibits a 'forward prediction' property [2]. Let h_{i-1}, h^*_{i-1} be two intermediate hash values with difference $h'_{i-1} = h_{i-1} + h^*_{i-1}$. Choose a value for m_i and compute $m^*_i = m_i + h'_{i-1}$. Then

$$h'_i = h_i + h^*_i = (1 + \theta) h'_{i-1} \ . \tag{4}$$

The function SMASH-256 is a specific instance of this general model. It is specified by setting $n = 256$, by defining the finite field via the irreducible polynomial $q(\theta)$,

$$q(\theta) = \theta^{256} + \theta^{16} + \theta^3 + \theta + 1 \ , \tag{5}$$

and by defining the mapping f.

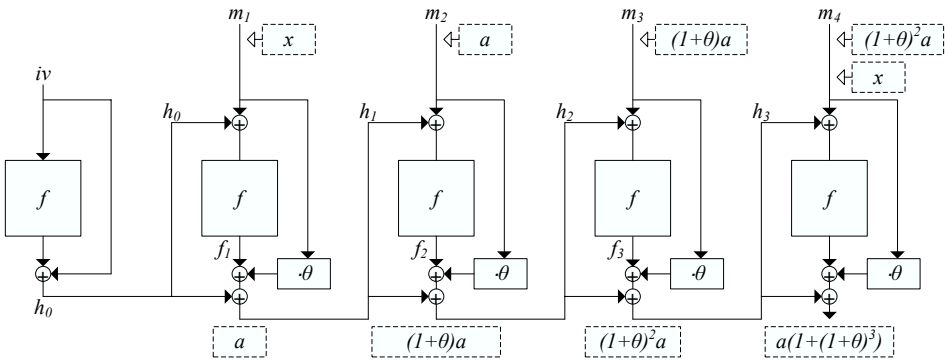

Fig. 1. The attack on a SMASH variant. The dashed rectangles denote differences.

3 Observation on the design method

We present here an observation on the design method explained in [2, Section 2]. The observation can be used to break SMASH-like hash functions, but it doesn't break SMASH-256 or SMASH-512. In Section 4, we explain how to extend this observation in order to break SMASH-256 and SMASH-512.

3.1 Target

In order to explain our attack, we first consider a simplified variant of SMASH. The variant differs from SMASH in the choice of the finite field element θ. We assume that we can choose a θ such that $(1+\theta)$ has order 3. Such a choice is not explicitly forbidden in [2].

3.2 Result

Define the following variables.

$$\begin{aligned} x &\text{ an arbitrary 256-bit value} \\ f_1 &= f(m_1 + h_0) \\ f_2 &= f(m_2 + h_1) \\ f_3 &= f(m_3 + h_2) \\ a &= f_1 + f(m_1 + h_0 + x) + \theta x \end{aligned}$$

The following 4-block messages $m = m_1 m_2 m_3 m_4$ all result in the same hash, for any value of z_1, z_2, z_3, and x. Note that a depends on both m_1 and x. In particular, if $x = 0$ then $a = 0$.

$$\begin{aligned} m_1 &= z_1 + x \\ m_2 &= z_2 + a \\ m_3 &= z_3 + (1+\theta)a \\ m_4 &= z_1 + f_1 + f_2 + f_3 + \theta(m_1 + m_2 + m_3) + (1+\theta)^2 a + x \end{aligned} \tag{6}$$

3.3 Description of the method

We describe here why we have a collision between two 4-block messages of the type (6): one message with $x = 0$ ('the first message') and one with $x \neq 0$ ('the second message'). The attack is illustrated in Figure 1.

The attack is an extension of the 'forward prediction' property observed in [2]. It can be verified that the value a is the difference in h_1. We cannot predict the value of a, but we can of course easily compute it once we have fixed z_1 and x.

By choosing the difference in the second message block equal to a, we ensure that the difference in h_2 equals $(1+\theta)a$. Similarly, by choosing the difference in the third message block equal to $(1+\theta)a$, we ensure that the difference in h_3 equals $(1+\theta)^2 a$. This was all already observed in [2].

Now we have to determine the last message block in each of the messages. We choose the last message block of the first message in such a way that the input of f in the last iteration equals the input of f in the first iteration.

$$\begin{aligned} m_4 &= m_1 + h_0 + h_3 \\ &= m_1 + h_0 + f_3 + h_2 + \theta m_3 \\ &= m_1 + h_0 + f_3 + f_2 + f_1 + h_0 + \theta(m_3 + m_2 + m_1) \\ &= m_1 + f_3 + f_2 + f_1 + \theta(m_3 + m_2 + m_1) \end{aligned}$$

The last block of the second message is selected such that the difference in the last message block equals $(1+\theta)^2 a + x$. This choice ensures that the two inputs of f in the last iteration equal the inputs in the first iteration. Consequently, the outputs of f will be the same as in the first iteration, hence they will have the same difference as in the first iteration: $a + \theta x$. Working out the equations, we see that the difference in h_4 becomes:

$$\begin{aligned} (f(m_1 + h_0) + h_3 + \theta m_4) + \big(f(m_1 + h_0 + x) + h_3 + (1+\theta)^2 a + \theta(m_4 + (1+\theta)^2 a + x)\big) \\ = a + \theta x + (1+\theta)^3 a + \theta x \\ = a\left(1 + (1+\theta)^3\right) \ . \end{aligned} \tag{7}$$

Since we assumed that $(1+\theta)$ has order 3, the difference (7) equals zero and we have produced a collision for our SMASH variant.

4 Attacking SMASH

In this section we explain how the attack can be extended to break the proposed SMASH functions. After a description of the general idea, we present some equations and solutions.

4.1 Brief description

The attack of the previous section can be extended to break all SMASH variants where the order of $(1+\theta)$ is one below the maximum message length (in blocks). If the order is larger, we can still produce colliding messages, but these messages are no longer valid inputs according to the SMASH specifications. It turns out that both SMASH-256 and SMASH-512 are safe, because the order of $(1+\theta)$ equals $(2^{256}-1)/5$ for SMASH-256, and $2^{512}-1$ for SMASH-512.

However, the attack technique can be generalized further. Previously, we extended the forward prediction property by considering message pairs that introduce a non-zero input difference x into f twice: once at the beginning and once at the end of the message. We can extend the property further by considering message pairs that introduce the difference x three or more times. Every time the input difference to f is non-zero, we make sure that the absolute values of the two message blocks equal the values in the first message blocks. Consequently, the output difference of f will be every time the same $(a + \theta x)$. In this way, we can produce almost any desired difference in h_t. In order to find a collision, we want to cause a difference of the form $h'_t = a \cdot q(\theta) = a \cdot 0 = 0 \pmod{q(\theta)}$.

4.2 Equations

In this section, we introduce some notation and list the equations that need to be solved in order to construct pairs of messages that result in a specific difference h_t. Without loss of generality, we will always work with messages that differ already in the first block ($m'_1 \neq 0$).

We define the following notation. Let d be a function defined for two input values only: $d(0) = 0$, and $d(x) = 1$. Let m'_i denote the difference in message block i. Let $\delta_1 = 1$ and let δ_i with $1 < i \leq t$, be defined as follows:

$$\delta_i = d(m'_i + \sum_{j=1}^{i-1} (1+\theta)^{i-j-1} a\delta_j) \ . \tag{8}$$

Then it is possible to construct two t-block messages with the differences defined by (8), such that the difference in h_t has the following value

$$a \sum_{i=1}^{t} (1+\theta)^{t-i} \delta_i \ . \tag{9}$$

The absolute values m_i can be determined as follows. The first block, m_1, can always be selected arbitrarily. If $\delta_i = 0$, then m_i can be selected arbitrarily. If $\delta_i = 1$ and $i > 1$, then m_i has to be equal to $h_{i-1} + m_1 + h_0$.

4.3 Solutions

The field polynomial $q(\theta)$ can be written as follows:

$$\theta^{256} + \theta^{16} + \theta^3 + \theta + 1 = (1+\theta) + (1+\theta)^2 + (1+\theta)^3 + (1+\theta)^{16} + (1+\theta)^{256} \ . \tag{10}$$

Hence, the solution of (9) is given by $\delta_i = 1$ for $i = 1, 241, 254, 255, 257$ and $\delta_i = 0$ for all other $i \leq t = 257$. Given the δ_i, (8) can be solved for the differences m'_i. This gives:

$$\begin{aligned}
m'_1 &= x \\
m'_i &= (1+\theta)^{i-2} a, \ \ 1 < i \leq 240 \\
m'_{241} &= x + (1+\theta)^{239} a \\
m'_i &= (1+\theta)^{i-2} a + (1+\theta)^{i-242} a, \ \ 241 < i < 254 \\
m'_{254} &= x + (1+\theta)^{252} a + (1+\theta)^{12} a \\
m'_{255} &= x + (1+\theta)^{253} a + (1+\theta)^{13} a + a \\
m'_{256} &= (1+\theta)^{254} a + (1+\theta)^{14} a + (1+\theta) a + a \\
m'_{257} &= x + (1+\theta)^{255} a + (1+\theta)^{15} a + (1+\theta)^2 a + (1+\theta) a \ .
\end{aligned}$$

Here x is an arbitrary difference. All other differences are defined by the attack method. As explained above, 253 of the message blocks m_i can be chosen, while the remaining 4 are determined by the attack.

5 Conclusion

We described an attack on SMASH. The attack works independently of the choice of the nonlinear function f and requires negligible computation power. The attack is based on two observations. Firstly, the property of 'forward prediction' which was described in [2]. Secondly, a differential attack on a hash function is easier than on a block cipher, because the attacker has control over the input values. If the attacker ensures that the two inputs to two different instantiations of the nonlinear function are equal, then the two outputs (and hence the output difference) will also be equal in both instantiations.

If the f function would be different in every iteration, then it would not be so easy to produce the same output difference twice. A carefully designed variation of f over the iterations might make our attack more difficult. If the function would depend on a secret key, as in a block cipher, then producing the same output difference twice would be infeasible.

References

1. Eli Biham, Adi Shamir, "Differential cryptanalysis of DES-like cryptosystems," *Journal of Cryptology,* 4(1), 1991, pp. 3–72.
2. Lars R. Knudsen, "SMASH - A Cryptographic Hash Function," *preproceedings of FSE 2005*, 2005, pp. 231–245.

A Example of colliding messages m and m^*

In this section we give an example of two messages, m and $m^* = m + m'$, that collide after 257 iterations. m_1 is the ASCII coded string:

<html>You owe me 1000.00€</html>

This string has been changed to m_1^*:

<html>You owe me 1000000€</html>

Using hex notation, the following table shows all input message blocks m_i and m_i^*, the initial chaining variables $h_0 = h_0^* = f(\mathrm{iv}) + \mathrm{iv}$, the chaining variables h_{257} and h_{257}^*, and the colliding outputs SMASH and SMASH*. As described in Section 4.3, the messages $m_2 \dots m_{240}, m_{242} \dots m_{253}$, and m_{256} can be chosen arbitrarily. In this example we have chosen them to be zero.

h_0=	55214e9e	237290c2	3ff782f7	c2073a8c	2105c5f1	6ccb0855	9c71b7c1	e7ecceac
h_0^*=	55214e9e	237290c2	3ff782f7	c2073a8c	2105c5f1	6ccb0855	9c71b7c1	e7ecceac
m_1=	3c68746d	6c3e596f	75206f77	65206d65	20313030	302e3030	803c2f68	746d6c3e
m_1^*=	3c68746d	6c3e596f	75206f77	65206d65	20313030	30303030	803c2f68	746d6c3e
m_2=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_2^*=	e59bfa30	3454d598	09287911	722a4933	81002ff7	f8254eb3	4d13afaa	ecc5834c
m_3=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_3^*=	2ead0e5b	5cfd7ea9	1b788b33	967edb55	83007019	086fd3d4	d734f0ff	354e85d4
m_4=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_4^*=	73f712ed	e50783fb	2d899d55	ba836dff	8500902a	18b0747d	795d1101	5fd38e7d
m_5=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_5^*=	94193737	2f08840d	769aa7fe	cf85b601	8f01b07f	29d09c86	8be73303	e0749287
m_6=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_6^*=	bc2a5952	71198c16	9bafe802	508eda03	9102d080	7a71a58b	9c295505	209db788
m_7=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_7^*=	c47eebf6	932a943b	acf03806	f1936e04	b3077180	8e92ee9c	a47bff0f	61a6d899
m_8=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_8^*=	4c833c1a	b57fbc4c	f510480b	12b5b20d	d5099281	93b733a5	ec8c0110	a2eb69aa
m_9=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_9^*=	d5844425	df80c4d4	1f30d81c	37ded616	7f1ab783	b4d954ee	35940331	e73dbaff
m_{10}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{10}^*=	7e8dcc64	60814d7d	21516825	58637a3a	812fd885	dd6bfd32	5ebc0552	2946cf01
m_{11}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{11}^*=	839654ac	a183d787	63f3b86f	e8a58e4e	8370698f	67bc0757	e3c40ff7	7bcb5103
m_{12}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{12}^*=	84bafdf4	e2847888	a414c8b0	39ee92d2	8590ba90	a8c409f8	244c1019	8c5df304
m_{13}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{13}^*=	8dce0617	278c8999	ec3d59d1	4a33b777	8eb1cfb0	f94c1a09	6cd4302a	94e6150c
m_{14}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{14}^*=	96530a32	68959aaa	3447ea73	de54d998	93d250d0	0bd42e1a	b57c507f	bd2a3f14
m_{15}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{15}^*=	baf41e5d	b9beafff	5cc83e95	62fd6aa8	b476f171	1c7c722f	df84f081	c77e413d
m_{16}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{16}^*=	cf1d22ec	cac3f000	e55843be	a707bff8	dc9b1393	24849670	608d1183	4982c346
m_{17}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{17}^*=	51276734	5f441001	2fe8c4c3	e908c009	65ad34b4	6d8dba91	a1973285	da8745ca
m_{18}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{18}^*=	f368a957	e1cc3003	70394d45	3b19401b	aef75ddd	b696cfb3	e2b9578f	6f89ce5f
m_{19}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{19}^*=	15b9fbf9	22545004	904bd7ce	4d2bc02d	f319e667	dbbb50d4	27cbf890	b09a52e0
m_{20}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

m_{20}^*=	3ecb0c00	66fcf00c	b0dc7852	d77c4076	152a2aa9	6ccdf17d	685c09b1	d1aef720
m_{21}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{21}^*=	435c140b	ab051014	d16488f6	7984c09b	3f7e7ffa	b5561387	b8e41ad3	72f31960
m_{22}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{22}^*=	c5e43c1d	fd0f303c	73ad991b	8a8d41ac	4182800e	dffa3489	c92c2f74	97152ba1
m_{23}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{23}^*=	4e2d442c	07115045	94f6ab2c	9f97c2f4	c2878013	600e5d9b	5b74719d	b93f7ce2
m_{24}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{24}^*=	d276cc7f	0933f0cf	bd1bfd74	a0b8471d	47888034	a012e6ac	ed9c92a7	cb418526
m_{25}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{25}^*=	769a548a	1b541150	c72c079c	e1c8c926	c899805d	e0372bf4	36a5b7e8	5dc28f6b
m_{26}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{26}^*=	9baefd9e	2dfc33f0	497408a4	22595b6b	59aa80e6	20597c1d	5beed839	e64791bd
m_{27}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{27}^*=	acf206a9	76045411	db9c19ec	66ebedbd	eaff812a	60eb8427	ec33684b	2ac8b2c7
m_{28}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{28}^*=	f5160bfb	9a0cfc32	6ca42a34	ab3c36c6	3f00837e	a13c8c68	3455b8dd	7f59d748
m_{29}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{29}^*=	1f3a1c0d	ae150457	b5ec7e5d	fd445b4a	41018583	e34594b8	5cfec966	81ea79d8
m_{30}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{30}^*=	214f241c	f23f0cf9	de3482e6	07cceddf	c3028e84	25cebdc8	e5035bab	823e8a68
m_{31}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{31}^*=	63d06c2f	1641150b	625d872b	08553660	4507938c	6e53c659	2f05ecfd	86439eb9
m_{32}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{32}^*=	a471b47a	3ac33f1d	a6e6897d	18ff5aa0	cf08b494	b2f44aeb	710e3507	8ac4a3cb
m_{33}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{33}^*=	ec93dc85	4f454126	eb2b9b87	2901efe1	5119ddbc	d71cdf3c	93125f08	9f4de45d
m_{34}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{34}^*=	35b56584	d1cfc36b	3d7cac89	7b023022	f32a66c4	79256144	b536e119	a1d62ce6
m_{35}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{35}^*=	5edeae87	725045bd	4785f59a	8d065066	157eab4c	8b6fa3cd	df5b232b	e27a752b
m_{36}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{36}^*=	e362f382	96f0cec7	c88e1eae	970af0aa	3f83fdd5	9db0e457	61ed657c	268e9f7c
m_{37}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{37}^*=	25a71486	bb115348	599223f3	b91f11ff	4084067e	a6d12cf9	a237af85	6b93a184
m_{38}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{38}^*=	6ee93d8a	cd33f5d8	eab66414	cb213201	c18c0a83	eb73750b	e658f08e	bcb4e28d
m_{39}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{39}^*=	b33a4695	57541e68	3fdaac3d	5d635602	42941f84	3d959f1c	2ae91193	c5dd2796
m_{40}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{40}^*=	d54fcbb4	f9fc22b9	406ff447	e7a5fa06	c7bc208c	46bea124	7f3b32b5	4e6768ba
m_{41}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{41}^*=	7fd05cdc	0a0467ca	c0b01cc8	28ee0e0a	48c46195	cbc3e36d	814d57df	d2a9b9ce
m_{42}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{42}^*=	8071e56f	1e0ca85e	41d02558	7932121f	d94ca2bf	5c4425b7	83d7f860	77faca53
m_{43}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{43}^*=	80922fb1	2215f8e3	c2706fe8	8b563621	6bd5e7c1	e4cc6ed8	847808a0	980f5ef4
m_{44}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{44}^*=	81b770d8	663e0924	4690b038	9dfa5a62	bc7e2842	2d54b368	8c8819e1	a811e31d
m_{45}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{45}^*=	82d89163	aa421b6d	cbb1d048	a60eeea6	c48278c7	77fdd5b9	95982a23	f8322526
m_{46}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{46}^*=	8768b3ae	fec62db6	5cd270d9	ea1333eb	4d868948	98067eca	bea87e65	08566f6b
m_{47}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{47}^*=	89b9d4f2	034a76db	e576916a	3e35543d	d68b9bd9	a80a835e	c3f882ae	18fab1bc
m_{48}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{48}^*=	9aca7d16	05de9b6c	2f9bb3be	425ffc46	7b9cac6b	f81f85e3	440987f3	290fd2c5
m_{49}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{49}^*=	af5e873a	0e63adb5	70acd4c2	c6e004ca	8ca5f4bd	08208e25	cc1a8814	7b10774f
m_{50}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{50}^*=	f1e3894e	12a4f6de	91f57d46	4b200d5e	95ee1dc6	1861926e	542f983c	8d3099d0
m_{51}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{51}^*=	12259bd9	37ed1b63	b21f87ca	dd6017e3	be32264a	28a2b6b3	fc70a844	9751aa70
m_{52}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{52}^*=	366fac60	58372da5	d620885e	67a03824	c2566adf	79e7dbd4	0491f8cc	b9f2fe91
m_{53}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{53}^*=	5ab1f4ab	e85976ef	7a6198e2	a8e0486d	46fabf61	8a286c7d	0db20954	ca1703b3
m_{54}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{54}^*=	efd31df6	38eb9b31	8ea2a927	f920d8b7	cb0fc1a2	9e78b487	16d61bfd	5e3904d5
m_{55}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

m_{55}^*=	3075261a	493cad52	93e7fb69	0b6169d8	5d1042e7	a289dd88	3b7a2c06	e24b0d7f
m_{56}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{56}^*=	509e6a25	db45f7f6	b4280dbb	1da3ba69	e730c729	e79a6698	4d8e740b	26dd1781
m_{57}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{57}^*=	f1a2be6f	6dce181a	dc7816cc	26e4ceba	2951497b	28aeaba9	d6929c1c	6b673883
m_{58}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{58}^*=	12e7c2b1	b652282f	64883b54	6b2d53cf	7bf3db8d	79f3fcfb	7bb7a424	bda94984
m_{59}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{59}^*=	372947d8	daf67871	ad984dfd	bd77f451	8c146c97	8a14050d	8cd8ec6c	c6fbda8c
m_{60}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{60}^*=	597ac863	6f1a8893	f6a8d606	c7981cf2	943cb5b8	9e3c0f16	956934b5	4b0c6f95
m_{61}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{61}^*=	eb8f58a5	b12f99b5	1bf97a0a	48a82517	bc45dec9	a244113b	bfbb5dde	dd14b0be
m_{62}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{62}^*=	3c90e9e4	d370aade	2c0b8e1f	d9f86f39	c4ce635b	e6cc334c	c0cde663	673dd1c3
m_{63}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{63}^*=	45b13a2c	7591ff62	741c9220	6a08b14b	4d52a5ec	2b5455d5	41562aa4	a9467244
m_{64}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{64}^*=	ced24e7f	9eb201a6	9c25b660	be19d3dd	d7f7ee34	7dfcfe7f	c3fa7fec	fbca96cc
m_{65}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{65}^*=	5377d28a	a3d602eb	a46edaa1	c22a7466	7818325d	86050280	440e8034	0c5fbb55
m_{66}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{66}^*=	f598779e	e47a073d	ecb36fe2	467e9cab	882856e6	8a0f0780	cc13805d	14e0cdff
m_{67}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{67}^*=	1ea898a2	2c8e0946	35d5b027	ca83a5fc	9878fb2a	9e110881	543480e6	3d215600
m_{68}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{68}^*=	23f9a9e6	75921bca	5e7ed069	5f84ee04	a8890d7f	a2331982	fc5d812b	4763fa00
m_{69}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{69}^*=	640afa2a	9eb62c5e	e28370bb	e08d320c	f99b1781	e6552a87	04e6837c	c9a40e01
m_{70}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{70}^*=	ac1e0e75	a3da74e2	278591cc	21975615	0aad3882	2aff7f88	0d2b8585	5aec1203
m_{71}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{71}^*=	f422129f	e46e9d27	688eb255	62b9fa3f	1ff74986	7f018098	177c8e8f	ef343605
m_{72}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{72}^*=	1c6737aa	2cb3a768	b993d6fe	a7ca0e41	2019da8a	810281a8	39859391	315c5a0f
m_{73}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{73}^*=	24a958fe	75d4e9b8	cab47b02	e85e12c2	602a6f9f	830782f8	4a8eb4b2	53e4ee11
m_{74}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{74}^*=	6dfbe902	9e7d3ac8	5fdc8d06	38e23747	a07eb0a0	85088708	df93ddd7	f42d3233
m_{75}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{75}^*=	b60d3b0d	a2874f58	e065970b	492659c9	e083d1e0	8f198919	60b46678	1c775654
m_{76}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{76}^*=	da174d17	e789d1e9	20aeb91c	db6aea5a	21847220	912a9b2a	a1dcaa89	2499fafc
m_{77}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{77}^*=	6e39d739	289a723a	61f3cb25	6dbf3eee	628c9661	b37fad7e	e265ff9a	6daa0f05
m_{78}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{78}^*=	b24a794b	79ae964e	a2145d6f	b6c14332	a795baa3	d580f782	26ae00af	b6fe110e
m_{79}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{79}^*=	d6df8bd6	8af3bad3	e63ce7b1	db43c557	e8becfe4	7e811887	6bf201f0	db023312
m_{80}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{80}^*=	7b619c71	9f14cf74	2a4528d2	6dc44ff8	39c3502d	83832988	bc160210	6d065536
m_{81}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{81}^*=	8da2a493	a13d519c	7ecf7977	b64cd008	4a45f077	84857a98	c43a0631	b70aff5b
m_{82}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{82}^*=	96e6edbe	e347f2a5	83518b98	dad57018	dece1098	8d8f8fa8	4c4e0a52	d91f01ec
m_{83}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{83}^*=	bb2a36c9	25c817ee	85f29ca9	6f7f9029	635231a9	969090f9	d4d21ef7	6b210234
m_{84}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{84}^*=	cd7e5b5b	6e583833	8e17a5fb	b180b07a	a5f652fb	bbb1b10b	7d762318	bd63065d
m_{85}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{85}^*=	5783ede6	b2e84854	9238ee0d	d281d08f	ee1af70c	ccd2d31c	879a6529	c7a50ae7
m_{86}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{86}^*=	f8853621	d738d8fc	b6493216	77827190	322f1915	55777525	88aeaf7a	48ef1f28
m_{87}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{87}^*=	098f5a63	79496905	dadb563b	988692b1	56712b3f	ff999f6f	99f3f18e	d9312179
m_{88}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{88}^*=	1a90eeae	8bdbbb0f	6f6dfa4d	a98bb7d2	fa937d40	00aaa1b1	aa141293	6b53638a
m_{89}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m_{89}^*=	2fb133f2	9c6ccd11	b1b60ed6	fa9cd876	0fb587c1	01ffe2d2	fe3c37b5	bdf5a49f
m_{90}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

m^*_{90}=	70d2541d	a4b55733	d2da137b	0fa5689b	10de8842	02002776	024458df	c61eeda0
m_{91}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{91}=	9177fc2c	eddff955	776e358c	10efb9ac	316398c6	0600699a	06cce961	4a2336e0
m_{92}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{92}=	b3980474	36600bfe	99b25e95	3130caf4	53a4a94a	0a00baae	0b553ba3	de655b20
m_{93}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{93}=	d4a90c97	5aa01c03	aad6e3bf	53515f1d	f4edfbde	1e01cff2	1dff4ce5	62afed60
m_{94}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{94}=	7dfb15b9	efe02404	ff7b24c1	f5f3e126	1d360c62	22025017	2601d52f	a7f037a0
m_{95}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{95}=	860c3ec0	30206c0c	018d6d42	1e14236b	275a14a7	6606f039	6a027f71	e81058e0
m_{96}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{96}=	8a15434b	5060b415	0297b7c6	223c65bd	69ee3de9	aa0b104b	be068193	3830e920
m_{97}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{97}=	9e3fc5dd	f0a1dc3e	07b8d84a	6644aec7	ba32463b	fe1d30dd	c20b82b4	48513b61
m_{98}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{98}=	a2404e67	11e26443	08c968df	aacdf349	ce56ca4d	02275166	461c87dd	d8f34da2
m_{99}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{99}=	e6c1d2a2	3226acc4	195bb961	ff5615db	52fb5ed6	0669f3ab	ca258867	6915d6e6
m_{100}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{100}=	2b4277e6	566bf54d	2beccba3	01fa3e6d	f70de37b	0aba14fd	5e6e98a9	bb3e7b2b
m_{101}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{101}=	7dc79821	fabc1fd7	7c355ce5	020e42b7	1916258d	1fce3d06	e2b3a9fb	cd428d7d
m_{102}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{102}=	8649a868	0fc42079	845fe52e	0612c7d9	2b3a6e97	2052470a	27d4fa0d	57c79786
m_{103}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{103}=	8adaf8b8	104c608a	8ce02f72	0a37486a	7d4eb3b9	60f6c91e	687d0e17	f848b88a
m_{104}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{104}=	9f6e09c3	30d4a19f	95207196	1e59d8bf	87d3d4cb	a11b5b22	b8871239	08d9c99e
m_{105}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{105}=	a1b21a45	517de2a0	bf6092ba	22ea69c0	88747d5d	e32ded67	c989364a	196a5aa3
m_{106}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{106}=	e2d62ecf	f38627e1	c1a1b7ce	673eba41	989c87e7	257637a8	5a9b5adf	2bbeefe4
m_{107}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{107}=	277a7351	148a6822	42e2d853	a943cec2	a9a58829	6f9a58f9	efadef61	7cc3302c
m_{108}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{108}=	698e95f3	3d9eb866	c72768f5	fbc45346	faee987a	b0aee90a	30f631a3	85455075
m_{109}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{109}=	ba92be1e	46a3c8aa	4969b91f	0c4cf5cb	0f33a88f	d1f33b1f	511a52e4	8fcff09f
m_{110}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{110}=	cfb6c229	cbe459ff	dbbacb21	14d51e5d	1154f991	72154d21	f32ef72d	905011a1
m_{111}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{111}=	50da4670	5c2cea00	6ccf5d62	3d7f22e6	33fd0ab3	963fd763	15731977	b0f032e2
m_{112}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{112}=	f16fca9b	e4753e00	b551e7a6	4781672a	54071fd5	ba4079a5	3f952b98	d1105726
m_{113}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{113}=	13b15fa6	2c9f4201	dff228eb	c883a97f	fc09207f	cec08aef	40bf7ca9	7330f96a
m_{114}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{114}=	34d3e0ea	75a1c603	6016793d	5984fb80	041b6080	53419f30	c1c185fa	95510bbe
m_{115}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{115}=	5d752135	9ee24a05	a03a8b47	ea8d0c80	0c2da180	f5c2a150	42428e0e	bff31cc3
m_{116}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{116}=	e79e6354	a326de0f	e04f9dc8	3f971581	1476e281	1e47e3f0	c6c79213	c0152545
m_{117}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{117}=	28a3a5f7	e56b6210	20d0a659	40b93e82	3c9b2783	22c82410	4b48b635	403f6fce
m_{118}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{118}=	79e4ee19	2fbda630	6171eaea	c1cb4386	45ad6885	67586c30	ddd9da5f	c041b052
m_{119}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{119}=	8a2c3220	70c6ea50	a3923f3e	425dc48a	cef7b98e	a9e8b450	666a6ee1	40c2d0f7
m_{120}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{120}=	9e745660	914b3ef1	e4b64142	c6e64d9f	5318ca92	fa39dcf1	aabeb322	c1477119
m_{121}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{121}=	a29dfaab	b3dd4312	2ddac3c7	4b2ad6a0	f5295fb7	0e4a6513	ffc3d567	43c9932a
m_{122}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{122}=	e7a60ffd	d467c537	766f4448	dd7f7be0	1f7be0d9	12deaf34	00447fa9	c45ab57f
m_{123}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{123}=	28eb100c	7ca84f58	9ab1ccd9	67818c20	218c216a	3763f15c	00cc80fb	4cefdf81
m_{124}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{124}=	793d3014	85f8d1e8	afd2556b	a8829461	629463be	59a413e4	0155810d	d5306083
m_{125}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

m^*_{125}=	8b465037	8e097238	f076ffbc	f987bca2	a7bca4c3	eaec342c	03fe8317	7f50a185
m_{126}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{126}=	9dcaf059	921b9649	109b00c5	0a88c5e7	e8c5ed44	3f345c75	04038538	81f1e28f
m_{127}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{127}=	a65e10e0	b62cbada	31ad014e	1f994e29	394e37cc	415ce49e	0c048f48	82122791
m_{128}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{128}=	eae3312b	da75cf6f	52f703d3	20abd27b	4bd25854	c3e52da2	140d91d8	863668b3
m_{129}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{129}=	3f245376	6e9e51b0	f7190474	61fc768d	dc76e8fc	442f76e6	3c16b269	8a5ab9d5
m_{130}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{130}=	416df591	b3a2f2d0	192b0c9c	a2049b96	649b3904	cc719b2b	443bd6bb	9eefca7f
m_{131}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{131}=	c3b71eb8	d4e71770	2b7d15a5	e60dacba	adad4b0d	5492ad7d	cc4c7bcc	a3305e81
m_{132}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{132}=	44d823c3	7d293991	7d873eee	2a16f5ce	f6f7dd16	fdb7f786	54d48c54	e550e382
m_{133}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{133}=	cd69644e	877b4ab3	86894332	7e3b1e52	1b18673a	06d8188b	fd7d94fd	2ff12486
m_{134}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{134}=	57bbacd2	898ddfd4	8b9bc557	824d22f7	2d28a94e	0b68299d	0786bd07	70136d8b
m_{135}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{135}=	f8ccf576	9a96607c	9cac4ff8	86d76718	7779fbd3	1db87aa7	088bc709	9035b69d
m_{136}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{136}=	09541f91	afbaa085	a5f4d009	8b79a929	998a0c74	26c88fe9	199c491b	b05edba7
m_{137}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{137}=	1bfd20b8	f0cfe18f	ee1d701a	9d8afb7a	aa9e149d	6b59903a	2aa4db2d	d0e36ce9
m_{138}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{138}=	2c0661c3	11502291	3227902f	a69f0d8f	ffa23da6	bdeab04f	7fed6d77	7125b53b
m_{139}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{139}=	740aa245	33f067b3	5668b071	eba11691	00e646eb	c63fd0d0	8037b798	936edf4d
m_{140}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{140}=	9c1ee6c4	5410a8d5	fab9d093	3ce33bb3	012acb3c	4a407170	8058d8a9	b5b361d6
m_{141}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{141}=	a4222b47	fc31f97e	0fca71b5	45254cd4	037f5d44	dec09390	80e969fb	ded5a27b
m_{142}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{142}=	ec677dc2	04520b83	105e92de	cf6fd57c	0581e7cc	6341b4b0	813bba0c	637ee68c
m_{143}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{143}=	34a98646	0cf61c84	30e3b762	51b07f84	0e822855	a5c2ddd0	834cce14	a5832b95
m_{144}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{144}=	5dfb8ac1	151a258c	5124d9a6	f2d0808c	138678ff	ee476670	85d5523d	ee857cbe
m_{145}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{145}=	e60d9f48	3f2e6e94	f36d6aea	17718194	348a8900	32c9aa90	8e7ff646	338f85c3
m_{146}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{146}=	2a16a1d8	4172b3bd	15b7bf3e	399282bd	5d9f9b00	575affb0	92801aca	54908e44
m_{147}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{147}=	7e3be268	c397d4c7	3ed8c142	4ab787c7	e6a0ad00	f9ef00d0	b7802f5e	fdb192cd
m_{148}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{148}=	824d26b3	44b87d49	436943c7	dfd88849	2be1f700	0a310171	d88071e3	06d2b756
m_{149}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{149}=	86d76bd5	cdc887da	c5bbc449	606998db	7c221901	1e530393	69809225	0b77d9fb
m_{150}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{150}=	8b79bc7f	5659886f	4ecc4cda	a0baa96c	84662b03	22f504b5	ba81b66f	1d986a0d
m_{151}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{151}=	9d8ac481	faea98b0	d354d56e	e1cffbb4	8caa7d04	671f0dde	cf82dab1	26a8be16
m_{152}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{152}=	a69f4d83	0f3fa9d1	75fd7fb3	22500cdd	95fe870d	a9211663	50876fd3	6bf9c23b
m_{153}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{153}=	eba1d685	1140fa72	9e0780d5	66f01567	be038917	fb633aa4	f189b074	bc0a464d
m_{154}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{154}=	3ce37b84	33c10e97	a208817f	ab103fa8	c2049b39	0da54fed	129ad09d	c41ecad6
m_{155}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{155}=	45248c87	544313b9	e6198381	fd3040f9	460dad4a	16efd036	37af71a7	4c235f7a
m_{156}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{156}=	cf6d9589	fcc534cb	2a2a8483	0750c10a	ca16f7df	3b30705a	58f192e9	d465e18e
m_{157}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{157}=	51b7be90	054f5d5c	7e7f8d84	09f1431e	5e3b1861	4d5090ef	e912b73b	7cae2292
m_{158}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{158}=	f2d8c3b0	0fd1e7e4	8280968c	1a13c522	e24d28a3	d7f1b131	3b37d94d	85f267b7
m_{159}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{159}=	176844db	1072282d	8781bb94	2e344f67	26d779e5	7812d352	4d586bd6	8e16a8d9
m_{160}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

m^*_{160}=	39b9cd66	30967877	8882ccbc	725cd1a8	6b798a2f	883775f6	d7e8bc7a	923bf96b
m_{161}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{161}=	4acb57a1	51ba8899	998755c4	96e572f9	bd8a9e71	98599e1a	7839c48f	b64c0bbc
m_{162}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{162}=	df5cf8e8	f2cf99ab	aa89fe4c	bb2f970a	c69fa292	a8eaa22f	884a4d90	dad41cc4
m_{163}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{163}=	61e40933	1750aafc	ff9a02d5	cd70b91f	4ba0e7b7	f93fe670	98ded6b1	6f7c254d
m_{164}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{164}=	a22c1b55	39f1ff04	00ae077f	5791cb20	dce128d8	0b402a90	a9637bd2	b1846fd6
m_{165}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{165}=	e6752df4	4a12010d	01f20981	f8b25d60	65237968	1dc07fb1	fba58c76	d28cb07b
m_{166}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{166}=	2a9e7617	de360316	02161a83	09d6e7a0	af658bb9	264080d3	0cee949a	7795d08c
m_{167}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{167}=	7fa29a39	625a053a	063a2f84	1a7b28e0	f1ae9ccb	6ac18174	1533bdae	98be7194
m_{168}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{168}=	80e6ae40	a6ee0f4e	0a4e708c	2e8d7920	12f3a55d	bf42839d	3f54c6f2	a9c292bc
m_{169}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{169}=	812af2cb	eb3211d3	1ed29195	73978b60	3714efe7	c1c784a7	41fd4b17	fa47b7c4
m_{170}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{170}=	837e1756	3d563274	2377b2be	94b89da0	593d3029	42488de9	c207dd38	0ec8d84c
m_{171}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{171}=	858239fa	47fa569d	6598d7c2	bdc9a6e0	eb47507a	c6d9963b	46086748	135968d5
m_{172}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{172}=	8e864a0e	c80efba6	aea97846	c65aeb20	3dc9f08f	4b6aba4c	ca18a9d9	35ebb97f
m_{173}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{173}=	938ade12	58130ceb	f3fb88cb	4aef3d61	465a1190	ddbfced4	5e29fa6b	5e3ccb80
m_{174}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{174}=	b49f6236	e835153c	140c995d	df3147a2	caee32b0	66c0537c	e27a0ebc	e2455c80
m_{175}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{175}=	dda0a651	385f3f45	3c15abe6	6153c8e6	5f3257d1	ab40f585	268e13c4	26cfe581
m_{176}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{176}=	66e1eaf3	48e141ce	443efc2a	a3f4592a	e156f873	fdc11e8f	6b92344d	6b502e83
m_{177}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{177}=	ab223f15	d923c252	cc43047e	e41ceb7e	23fb0894	06432390	bcb65cd6	bdf07385
m_{178}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{178}=	fd674134	6b6446f7	54c50c83	2c253d83	640d19bd	0ac564b0	c5dae57a	c610948e
m_{179}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{179}=	07a8c357	bdaccb18	fd4f1585	746f4685	ac172ac7	1f4fadd0	4e6f2f8e	4a31bd93
m_{180}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{180}=	08f945f9	c6f55d28	07d13e8e	9cb1cb8e	f4397f49	21d0f671	d2b17092	de52c6b5
m_{181}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{181}=	190ace00	4b1fe778	08734393	a5d25c92	1c4b81da	62711a92	77d391b6	62f74bde
m_{182}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{182}=	2b1f5200	dd202988	1895c4b5	ee76e5b6	24dc826f	a6932fb6	9874b2da	a719dc62
m_{183}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{183}=	7d20f60b	67607a98	29be4dde	329b2eda	6d6586b0	ebb570da	a89dd76f	e92a64a7
m_{184}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{184}=	87601a16	a9a08fa8	7ac2d662	57ad736e	b7ae8bd0	3cdf916e	f9a679b0	3b7eade8
m_{185}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{185}=	89a02e3a	fae190f9	8f477aa7	f8f795b2	d8f39c70	4560b3b3	0aea8ad0	4d83f639
m_{186}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{186}=	9ae0724e	0f22b10a	91c98fe8	0918bed7	6914a491	cfa1d4d4	1f3f9f70	d6841a4b
m_{187}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{187}=	af2196d9	1167d31f	b25a9038	1b29c378	bb3dedb3	50e27d7c	2140a191	7b8c2edd
m_{188}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{188}=	f162bb6b	33a87520	d6efb048	2d7a4589	cd4636d5	f1268785	63c1e2b3	8c947367
m_{189}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{189}=	13a6cdb6	54f89f61	7b30d0d8	778ece9a	57ca5b7f	136b888e	a44227d4	95bc95a9
m_{190}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{190}=	34ea56d1	fd09a1a3	8d517168	989353ae	f85eed81	35bc9992	ecc6687c	bec5befa
m_{191}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{191}=	5d3ffb78	071ae2e5	97f393b9	a9b5f4f3	08e33682	5ec5aab7	354ab884	c34ec30f
m_{192}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{192}=	e7410d83	092f272f	b814b4cb	fade1d14	19255b87	e34effd9	5fdfc98c	45d34511
m_{193}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{193}=	29c31685	1b716970	c83ddd5d	0f62273d	2b6fec88	25d3006b	e0605a95	ce75cf33
m_{194}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{194}=	7a443b84	2d93bb90	584667e7	11a66946	7db03598	6e7500bd	20a0efbf	529e5154
m_{195}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

m^*_{195}=	8ecc4c8c	76b4ccb0	e8caa829	32eabbca	86d05ea8	b29f01c7	61e130c1	f7a2f3fc
m_{196}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{196}=	9355d59f	9bdd55d1	395ff87b	573fcc5f	8b70e3f8	d7a10248	a2235142	18e71404
m_{197}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{197}=	b5fe7ea1	ac67fe72	4be0088c	f94054e1	9d912408	78e306d9	e665f3c7	29293c0d
m_{198}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{198}=	de0283e3	f4a80297	dc201995	0bc0fd23	a6b36c19	89250b6a	2aae1449	7b7b4416
m_{199}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{199}=	62078425	1df807b8	64602abe	1c410764	ebd5b42b	9b6f1dbf	7ff23cda	8d8dcc3a
m_{200}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{200}=	a6098c64	260808c8	aca07fc2	24c309ac	3c7edc7d	adb126c0	8016456f	9696544e
m_{201}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{201}=	ea1b94a7	6a181959	f5e08046	6d451af5	44836487	f6d36b40	803acfb0	bbbafcd3
m_{202}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{202}=	3e2dbde2	be282bea	1e2180ca	b7cf2f1e	cd85ad89	1b75bdc0	804f50d1	cccf0574
m_{203}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{203}=	4277c62d	c2787c3e	2262815f	d8517122	568ef69a	2d9ec641	80d1f173	55510f9d
m_{204}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{204}=	c6984a77	46888442	66a783e0	68f39366	fb931baf	76a34ac3	81721395	fff310a6
m_{205}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{205}=	4ba9de92	cb998cc7	abe88420	b914b5aa	0cb52cf1	9be5df44	839634bf	001531eb
m_{206}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{206}=	dcfa63b6	5caa9549	fc398c61	cb3ddeff	15df7512	ac2e61cc	84ba5dc0	003f523c
m_{207}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{207}=	650ea4da	e5ffbfda	044a94a3	5d466300	3e619f37	f472a254	8dcee641	0041f645
m_{208}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{208}=	af13ed6e	2e00c06e	0cdfbde4	e7caa500	42a2a159	1c97e6fc	96532ac2	00c21ace
m_{209}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{209}=	f13437b2	720140b3	1560c62c	285fef00	c7e7e3ea	25b82b04	baf57f46	01462f53
m_{210}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{210}=	135c58d6	9603c1d4	3fa14a74	78e03100	4828243e	6ec87d0d	cf1f81ca	03ca71f4
m_{211}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{211}=	35e4e97a	ba04427c	40e3de9d	89205300	d8786c42	b3588717	5120825e	045e921d
m_{212}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{212}=	5e2d3b8e	ce0cc684	c12463a6	9b60f500	6888b4c7	d5e98938	f36186e3	0ce3b627
m_{213}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{213}=	e2774c92	52154b8c	436ca4eb	ada11f01	b999dd48	7e3a9b48	15a28b24	1524da68
m_{214}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{214}=	2699d5b6	f63fdc95	c5b5ed3d	f6e32103	caaa67d9	824fadd9	3ee79d6c	3f6d6eb8
m_{215}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{215}=	6baa7eda	1a4065bf	4ede3746	1b256304	5ffea86a	86d0f66a	4328a7b5	41b7b3c8
m_{216}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{216}=	bcfe836e	2ec0aec1	d36259ca	2d6fa50c	e003f8be	8b711abe	c579e8de	c2d8d458
m_{217}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{217}=	c50285b9	7341f342	75a6ea5e	77b0ef15	200409c2	9d932fc3	4f8a3963	47697ce9
m_{218}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{218}=	4f078ecb	95c215c7	9eeb3ee2	98d1313f	600c1a46	a6b57045	d09e4ba4	c9bb853b
m_{219}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{219}=	d1099356	be463e49	a33d4327	a9735340	a0142ecb	ebdf90cf	71a2dced	5acc8f4c
m_{220}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{220}=	731ab5fa	c2ca42da	e547c568	fb95f5c1	e03c735c	3c60b150	92e76536	ef5591d4
m_{221}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{221}=	952ede05	475ec76e	2fc84fb9	0cbe1e42	204495e5	44a1d3f1	b729af5a	31feb27d
m_{222}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{222}=	bf73620f	c9e349b3	7058d0cb	15c222c6	60cdbe2f	cde27413	d97af1ee	5203d686
m_{223}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{223}=	c195a611	5a25dad4	90e9715c	3e46674a	a156c271	56269c35	6b8f1233	f6047b8b
m_{224}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{224}=	42bfea38	ee6e6f7d	b13b93e4	42caa9df	e3fb4693	fa6ba45e	bc913655	1a0c8c9d
m_{225}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{225}=	c7c03e48	32b2b187	d34cb42d	c75ffa60	240dcbb5	0ebcece3	c5b35afe	2e1595a6
m_{226}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{226}=	484042d8	57d7d288	75d5dc77	49e00ea1	6c165cde	13c53525	4ed5ef02	723ebeeb
m_{227}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{227}=	d8c0c768	f8787798	9e7e6499	da2013e3	b43ae562	344f5f6f	d37e3106	9643c33d
m_{228}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{228}=	694049b3	088898a9	a282adaa	6e603424	dc4f2fa7	5cd1e1b0	7582530a	bac44546
m_{229}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{229}=	bbc1dade	1999a9fb	e787f6fe	b2a05c6d	64d170e9	e57222d1	9e86f51e	cf4ccfca
m_{230}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

m^*_{230}=	cc436f69	2aaafa0c	28881b02	d7e0e4b6	ad73913a	2f966773	a38b1f23	51d5505f
m_{231}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{231}=	54c5b1bb	7fff0e15	79982d06	78212dda	f794b34f	70baa994	e49d2165	f27ff0e0
m_{232}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{232}=	fd4fd2c6	8001123f	8aa8770a	8863766e	18bdd5d1	91cffabd	2da763af	16801121
m_{233}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{233}=	07d0774a	80033640	9ff8991f	98a59ab3	29c67e72	b2500fc7	76e9a4f0	3b803363
m_{234}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{234}=	087099de	80055ac0	a009ab20	a9eeafd4	7a4a8297	d6f01049	9b3aed11	4c8055a5
m_{235}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{235}=	1891aa62	800fef40	e01afd61	fa33f07d	8edf87b8	7b1030db	ad4f3732	d580feee
m_{236}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{236}=	29b3fead	801031c0	202f07a2	0e541086	936088c9	8d30516c	f7d15956	7e810333
m_{237}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{237}=	7ad403f7	80305240	607108e7	12fc318a	b5a1995b	9750f3b5	1873ebfb	83830554
m_{238}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{238}=	8f7d0412	8050f6c0	a0931928	3704529e	dee2abed	b9f114de	28943c0c	84850ffc
m_{239}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{239}=	91860c3d	80f11b41	e1b52b79	590cf7a3	6327fc37	ca133d63	79bc4415	8d8f1004
m_{240}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{240}=	b28b144c	81132dc2	22df7d8a	eb1518e4	a5680459	5e3547a5	8ac4cc3e	9691300c
m_{241}=	bb9f291f	7296ad93	e9a62049	a3d2736d	d7efbf03	3d0b67f1	d44e71dc	f18e2f28
m^*_{241}=	6c0315c0	f1a3dbd4	8ec7a6d6	9eed5a41	3857b3e9	df4aaf1f	4b03259e	4a3d7f3d
m_{242}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{242}=	9d3ebf5a	b10b4f50	a08af2b1	356b3247	b1c83ac9	dec51780	ecc4536d	20107372
m_{243}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{243}=	a743c1ee	d31dd1f1	e19f17d2	5fbd56c8	d2584f5b	634f3881	354cf5b6	60309597
m_{244}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{244}=	e9c44232	75267212	22a13877	e0c7fb59	76e8d1ed	a5d14982	5fd51eda	a051beb9
m_{245}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{245}=	3a4dc65d	9f6a9637	67e34899	21480deb	9b397236	ee73da86	e07f236f	e0f2c3cb
m_{246}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{246}=	4ed74aec	a1bfba59	a825d9aa	63d8163d	ad4b965a	32946f8b	208165b0	2117445c
m_{247}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{247}=	d379df34	e2c0ceeb	f86e6aff	a4683a46	f7dcbaee	57bcb09c	6183aed0	6339cce4
m_{248}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{248}=	758a615c	2741533c	08b2bf00	ecb84ecb	1865cf33	f8c5d1a5	a284f370	a54a552c
m_{249}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{249}=	9e9fa3ef	69c3f544	19d7c100	35c8d35d	28ae5154	094e72ef	e78d1591	efdeff75
m_{250}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{250}=	a3a1e43a	ba441fcd	2a784300	5e5975e7	79f2f3fc	1bd29731	28973eb3	3063019e
m_{251}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{251}=	e4e22c4e	cecc2056	7e88c501	e2eb9e29	8a171404	2c77b953	79b943d5	50a502a2
m_{252}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{252}=	2d2674d2	535460fb	83994f02	273ca27b	9e393c0d	7498cbf4	8acbc47f	f1ef07e6
m_{253}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{253}=	776b9d7d	f5fca10d	84abd106	6945e68c	a24b4417	9da95c1d	9f5c4c81	1231082b
m_{254}=	5cefbc2f	2cf4cbc9	b4b78b05	c4fbd3c0	1b50fb58	9a7063a1	3c0bb73f	4b003568
m^*_{254}=	c5531ba8	32f128de	394bf80e	7f35f855	fd8d3761	3c958787	9def62bd	7d532d14
m_{255}=	c17d180c	db400973	678c7e34	31bbc42c	16c770bb	d38de279	5ca12f5b	007beddf
m^*_{255}=	8e230ab5	cd1af9d3	f8a09238	8fc3f1a1	bca10b06	c0ba80a1	f39ffe76	b64b4616
m_{256}=	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
m^*_{256}=	3478cdf0	0ebbc478	a85d4d05	b0a217a5	7faaa331	cd5ee9da	bc50dcdd	36947f16
m_{257}=	1cdf6e29	58f91cfc	b14182e9	4675b348	7be44ef7	b247a7fa	9ee4abb3	0e03ad65
m^*_{257}=	40563839	4b355074	49a655e6	97938ba6	fb1baba5	e5ba9d94	5a15ced5	55bf2c5e
h_{257}=	686554f5	081ab981	23418980	110e325d	b62e5b8a	f73096f1	a7dd9266	5cfee75b
h^*_{257}=	686554f5	081ab981	23418980	110e325d	b62e5b8a	f73096f1	a7dd9266	5cfee75b
SMASH=	cc0b34fd	3821b07e	ebccecc3	dc983778	cb0538f2	c5295b83	d0b0aa38	4325e171
SMASH*=	cc0b34fd	3821b07e	ebccecc3	dc983778	cb0538f2	c5295b83	d0b0aa38	4325e171