清华大学本科生考试试题专用纸

考试课程：**操作系统（B 卷）**　　时间：2015 年 04 月 13 日下午 1:30~3:05

系别：_____ 班级：_____ 学号：_____ 姓名：

答卷注意事项：
1. 答题前，请先在试题纸和答卷本上写明 A 卷或 B 卷、系别、班级、学号和姓名。
2. 在答卷本上答题时，要写明题号，不必抄题。
3. 答题时，要书写清楚和整洁。
4. 请注意回答所有试题。本试卷有 6 个题目，共 13 页。
5. 考试完毕，必须将试题纸和答卷本一起交回。

一、（10 分）如果 80386 机器的一条机器指令(指字长 8 个字节)，其功能是把一个 32 位字的数据装入寄存器，指令本身包含了要装入的字所在的 32 位地址。指令和数据的地址可不按 8 字节或 4 字节对齐。这个过程最多会引起几次缺页中断？请说明理由。

二、（20 分）uCore OS 在启动过程中, 经历了多次地址映射的变化, 理解这些变化对使用 gdb 调试 uCore 启动初期的代码十分重要。下面的描述中假定你已完成实验二的练习。

1） (启动) 对于 x86 机器, 加电后处于实模式下, 并且 cs 寄存器的段选择子部分为 0xf000,隐藏的基址部分为 0xffff0000, eip 寄存器为 0xfff0, 则此时待执行的指令的物理地址为(---1---).

2） (16 位实模式) 执行完第一条 ljmp 指令后, cs 寄存器的段选择子部分变为 0xf000, eip 变为 0xe05b, 则此时待执行指令的物理地址为 (---2---).

3） (进入 32 位保护模式) BIOS 会将 ucore bootloader 加载到物理地址 0x7c00, 且设置 cs 为 0x0,eip 为 0x7c00. 在 bootloader 中, 使用 lgdt 加载了如下全局描述符表, 然后进入 32 位保护模式. 此时为了正常工作, 应该用 ljmp 将 cs 设置为 (---3.1---), 将 ds/es/fs/gs/ss 设置为 (---3.2---). 此时若 eip 为 0x7c6d, 则实际被执行指令的物理地址为 (---3.3---).

注: 一个段描述符占 8Byte.

```
SEG_NULLASM                                  # null seg
SEG_ASM(STA_X|STA_R, 0x0, 0xffffffff) # code seg for bootloader and kernel
SEG_ASM(STA_W, 0x0, 0xffffffff)      # data seg for bootloader and kernel
```

当 bootloader 将其加载到内存时, 使用的逻辑地址是 (---3.4---), 对应的线性地址是 (---3.5---)，对应的物理地址是(---3.6---)。

4） (32 位保护模式，调整段映射) 根据 tools/kernel.ld, ucore kernel 的入口点 kern_entry 的逻辑地址为 0xC0100000。ucore bootloader 跳转到 ucore kernel 的 kern_entry 执行后, ucore kernel 首先加载了新的全局描述符表:

```
#define KERNBASE 0xC000 0000
SEG_NULL
SEG_ASM(STA_X | STA_R, - KERNBASE, 0xFFFFFFFF)          # code segment
SEG_ASM(STA_W, - KERNBASE, 0xFFFFFFFF)                    # data segment
```

完成加载后, 访问逻辑地址 0xC010002A, 对应的线性地址是(---4.1---)，对应物理地址 (---4.2---).

5） (32 位保护模式 建立分页机制) 在 ucore kernel 初始化过程中, boot_map_segment 函数 建立了初始的二级页表内容,可将线性地址 0xC0000000 映射到物理地址 0x0. 但是考虑到使能分页机制之后,段映射和页映射同时生效，所以需要在使能分页机制前，建立页映射关系，使得可将线性地址空间 0~4MB 映射到物理地址空间 0~4MB，且 ucore kernel 在使能了分页机制之后, 还需紧接着最后一次加载新的全局描述符表，并取消将线性地址空间 0~4M 映射到物理地址空间 0~4M，从而才算完成了分页机制的建立。

```
SEG_NULL,
[SEG_KTEXT] = SEG(STA_X | STA_R, 0x0, 0xFFFFFFFF, DPL_KERNEL),
[SEG_KDATA] = SEG(STA_W, 0x0, 0xFFFFFFFF, DPL_KERNEL),
[SEG_UTEXT] = SEG(STA_X | STA_R, 0x0, 0xFFFFFFFF, DPL_USER),
[SEG_UDATA] = SEG(STA_W, 0x0, 0xFFFFFFFF, DPL_USER),
[SEG_TSS]    = SEG_NULL,
```

在 ucore kernel 建立页机制过程中, 使能分页机制前, 逻辑地址 0xC010 0000 对应线性地址 (---5.1---) 和物理地址 (---5.2---);

使能了分页机制之后，完成分页机制建立之前, 逻辑地址 0xC010 0000 对应线性地址 (---5.3---) 和物理地址 (---5.4---);

完成分页机制建立之后, 逻辑地址 0xC010 0000 对应线性地址 (---5.5---) 和物理地址 (---5.6---);

三、（20 分）1）请描述时钟（clock）置换算法和先进先出置换算法的工作原理。

2）假定一个进程的虚拟存储访问序列如下。

a, b, c, d, a, b, e, a, b, c, d, e

请分别计算上述进程在分配 3 个物理页帧和 4 个物理页帧时的缺页次数。要求给出计算过程。

3）什么是 belady 现象？先过先出置换算法存在 belady 现象吗？时钟置换算法存在 belady 现象吗？如果存在，请尝试给出反例。如果不存在，请给出解释。

四、（20 分）下面是与进程切换相关的 ucore 代码。请基于代码分析回答下面问题。

1）switch_to 函数的返回地址是放在哪个进程的堆栈中的？

2）在 switch.S 文件中执行时，切换前和切换后的进程的上下文(context)首地址在哪？

3）进程切换代码中，完成页表切换的代码行是什么？

4）进程切换代码中，完成内核堆栈切换的代码行是什么？

代码如下：

```
// Saved registers for kernel context switches.
// Don't need to save all the %fs etc. segment registers,
// because they are constant across kernel contexts.
// Save all the regular registers so we don't need to care
// which are caller save, but not the return register %eax.
// (Not saving %eax just simplifies the switching code.)
// The layout of context must match code in switch.S.
struct context {
```

```
    uint32_t eip;
    uint32_t esp;
    uint32_t ebx;
    uint32_t ecx;
    uint32_t edx;
    uint32_t esi;
    uint32_t edi;
    uint32_t ebp;
};

#define PROC_NAME_LEN            15
#define MAX_PROCESS              4096
#define MAX_PID                  (MAX_PROCESS * 2)

extern list_entry_t proc_list;

struct proc_struct {
    enum proc_state state;                  // Process state
    int pid;                                // Process ID
    int runs;                               // the running times of Proces
    uintptr_t kstack;                       // Process kernel stack
    volatile bool need_resched;             // bool value: need to be rescheduled to release CPU?
    struct proc_struct *parent;             // the parent process
    struct mm_struct *mm;                   // Process's memory management field
    struct context context;                 // Switch here to run process
    struct trapframe *tf;                   // Trap frame for current interrupt
    uintptr_t cr3;                          // CR3 register: the base addr of Page Directroy Table(PDT)
    uint32_t flags;                         // Process flag
    char name[PROC_NAME_LEN + 1];           // Process name
    list_entry_t list_link;                 // Process link list
    list_entry_t hash_link;                 // Process hash list
    int exit_code;                          // exit code (be sent to parent proc)
    uint32_t wait_state;                    // waiting state
    struct proc_struct *cptr, *yptr, *optr;    // relations between processes
};



static inline void lcr3(uintptr_t cr3)
{
    asm volatile ("mov %0, %%cr3"::"r" (cr3));
```

```
}


/* *
 * load_esp0 - change the ESP0 in default task state segment,
 * so that we can use different kernel stack when we trap frame
 * user to kernel.
 * */
void
load_esp0(uintptr_t esp0) {
   ts.ts_esp0 = esp0;
}
void
proc_run(struct proc_struct *proc) {
    if (proc != current) {
        bool intr_flag;
        struct proc_struct *prev = current, *next = proc;
        local_intr_save(intr_flag);
        {
            current = proc;
            load_esp0(next->kstack + KSTACKSIZE);
            lcr3(next->cr3);
            switch_to(&(prev->context), &(next->context));
        }
        local_intr_restore(intr_flag);
    }
}


.text
.globl switch_to
switch_to:                      # switch_to(from, to)


    # save from's registers
    movl 4(%esp), %eax          # eax points to from
    popl 0(%eax)                # save eip !popl
    movl %esp, 4(%eax)
    movl %ebx, 8(%eax)
    movl %ecx, 12(%eax)
    movl %edx, 16(%eax)
    movl %esi, 20(%eax)
    movl %edi, 24(%eax)
```

```
    movl %ebp, 28(%eax)

    # restore to's registers
    movl 4(%esp), %eax          # not 8(%esp): popped return address already
                                # eax now points to to
    movl 28(%eax), %ebp
    movl 24(%eax), %edi
    movl 20(%eax), %esi
    movl 16(%eax), %edx
    movl 12(%eax), %ecx
    movl 8(%eax), %ebx
    movl 4(%eax), %esp

    pushl 0(%eax)               # push eip
    ret
```

五、（20 分）有一台假想的计算机 x86-lite，页大小（page size）为 32 Bytes，支持 8KB 的虚拟地址空间（virtual address space）,有 4KB 的物理内存空间（physical memory），采用二级页表，一个页目录项（page directory entry ，PDE）大小为 1 Byte,一个页表项（page-table entries PTEs）大小为 1 Byte，1 个页目录表大小为 32 Bytes，1 个页表大小为 32 Bytes。页目录基址寄存器（page directory base register，PDBR）保存了页目录表的物理地址 （按页对齐）。在 x86-lite 计算机中的 4KB 的物理内存空间和 4KB 的 disk 空间的值，PDBR 的值如题后所示。

PTE 格式（8 bit） : VALID | PFN6 ... PFN0 或者 VALID | DSN6 ... DSN0
PDE 格式（8 bit） : VALID | PT6 ... PT0

其中：
VALID 为第 7 位
VALID==1 表示，表示映射存在；
VALID==0 表示，表示内存映射不存在，并有 3 种情况：

a.如果是 PTE,且项的内容不为 0x7F，则表示对应的物理页帧号 swap out 在硬盘上,扇区号为物理页帧号；

b.如果是 PTE,且项的内容为 0x7F，则表示既没有在内存中，也没有在硬盘上

c.如果是 PDE,则表示既没有在内存中，也没有在硬盘上

PFN 6..0 :页帧号
DSN 6..0 :硬盘扇区号
PT 6..0 :页表的物理基址>>5
PDBR :页目录基址寄存器,保存了页目录表的物理地址（按页对齐）。

1)、 请接合上述假想计算机 x86-lite, 描述二级页表机制的基本运行机理。

2)、对于一个给定的 vaddr 值（即一个虚地址）和 pdbr 值（即页目录基址寄存器的值），请用 C 语言表达式表示：

(2. 1) vaddr 对应的页目录项（PDE）的 index

(2. 2) vaddr 其对应的页表项（PT）的 index

(2. 3) vaddr 对应的 paddr(物理地址值)

(2. 4) 请回答下列 vaddr 虚地址是否有合法对应的物理内存，请给出对应的 PDE index, PDE contents, PTE index, PTE contents，paddr(物理内存地址)，contents of paddr (物理内存地址内容)，或 saddr(磁盘扇区地址)，contents of saddr (磁盘扇区内容) 。

vaddr 137d

vaddr 01bb

vaddr 297d

vaddr 1c99

格式

vaddr 0c9e:

--> pde index:0x3 pde contents:(valid 1, pfn 0x6a)

--> pte index:0x4 pte contents:(valid 1, pfn 0x43)

--> To Physical Address 0x87e --> Value: 06

```
PDBR content: 0xf40 [This means the base address of page directory table is held in here]
-----------------------------------------------------------------------------------------------------
page 00: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 01: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 02: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 03: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 04: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 05: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 06: 0a 0e 1b 1e 1b 13 11 06 12 05 09 19 11 16 0e 08 0f 11 07 1a 1e 05 07 19 16 06 12 07 1a 12 0f 05
page 07: b6 16 7f cf 7f d3 22 4c 97 2b 7f 7f 6c 7f f0 32 13 51 7f 72 dc c1 7f 7f 7f 7b 7f c2 7f 7e 3a 7f
page 08: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 09: 08 0b 1c 02 17 05 11 0c 0e 17 0c 03 03 02 1a 13 1d 15 00 14 18 16 0f 0b 0e 18 08 10 0e 1d 18 1c
page 0a: 7f f2 b5 57 44 7f 7f e1 d8 7f af 1e 28 d2 7f 35 21 a0 25 8c 1a 8b 03 7f 7f dd 7f 4b 7f ad 0e 23
page 0b: 05 0d 0c 14 19 0a 1c 14 0a 05 1d 14 01 15 0b 0d 17 06 08 10 1c 02 19 16 05 14 13 16 10 09 0f 07
page 0c: 07 05 15 0b 0b 18 07 19 13 0c 19 0a 1b 1c 0f 15 1d 17 17 1a 1d 17 1e 09 13 14 0b 0c 05 1d 0a 0e
page 0d: 0a 05 04 14 02 1e 14 01 1b 07 0e 11 04 0f 01 06 1c 19 10 15 1b 04 0f 04 03 03 06 01 06 0b 13 1a
page 0e: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 0f: 0b 13 0e 07 18 1d 14 10 04 0e 18 09 0d 0d 09 13 09 1c 19 09 02 00 19 0d 03 01 18 06 1c 0b 13 0a
page 10: 00 0a 0b 1c 1b 17 0d 10 07 19 0c 08 13 04 09 1c 02 04 06 07 0d 07 0a 07 07 12 0a 0b 17 01 04 1a
```

```
page 11: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 12: 08 03 01 11 1e 00 1b 08 04 00 0a 02 0f 0e 05 1b 12 17 07 16 15 18 05 1d 0e 02 1c 09 1b 06 02 0f
page 13: 17 09 04 03 06 15 03 01 07 01 16 17 10 0a 01 16 07 11 1e 07 15 0d 10 0c 15 10 01 19 07 0a 0e 12
page 14: 02 19 04 0f 16 15 06 18 01 11 1b 10 09 1e 16 18 1b 1c 11 19 0f 07 08 08 00 13 0c 1c 01 18 06 0a
page 15: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 16: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 17: 15 0b 01 1e 04 01 0a 13 17 03 0a 00 0d 17 16 1b 17 1a 15 0e 06 14 09 03 0d 1b 03 12 0c 0f 04 1d
page 18: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 19: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 1a: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 1b: 0e 10 0f 1d 1d 01 0c 10 14 10 19 03 0e 19 05 05 13 04 10 03 05 0a 18 12 12 13 0c 1e 12 13 02 07
page 1c: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 1d: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 1e: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 1f: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 20: 16 0a 0d 0c 19 00 11 04 04 12 0b 02 12 1c 13 0f 18 1c 04 09 1d 1c 06 15 1b 12 15 10 07 06 01 14
page 21: 07 09 06 1c 13 01 02 05 1e 0a 18 06 06 1d 02 0f 10 0a 17 1a 07 09 0f 0e 13 18 0a 1d 0e 00 0d 10
page 22: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 23: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 24: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 25: 07 0f 08 0d 15 1c 12 19 02 0b 1e 04 0c 02 02 1b 1e 14 03 09 07 14 15 0d 10 03 10 1d 17 02 10 16
page 26: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 27: 7c 8f df 39 d7 69 7f 7f 7f 7f 7f 7f 3e 7f 2c 7f 7f 9b 3f 3b 7f 7f a5 00 1f 7f 7f 7f 7f 7f 0c 7f
page 28: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 29: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 2a: 08 0f 00 02 17 05 17 18 0c 14 18 1a 04 05 0b 0e 09 00 11 1d 0b 10 0b 0d 1a 09 14 0e 10 1c 02 19
page 2b: 0c 12 17 1a 0a 12 13 15 12 0e 19 00 18 05 05 14 0e 0a 02 01 08 02 15 06 0b 0d 15 19 13 06 04 11
page 2c: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 2d: 08 05 17 0f 10 19 00 10 0a 07 19 07 0c 0d 04 09 00 0f 13 1e 1d 0a 1d 03 04 10 15 12 01 0c 0f 0b
page 2e: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 2f: 1e 0d 14 1b 01 09 0c 07 0b 15 04 15 09 14 05 18 0c 19 1d 12 00 0b 1e 14 17 0e 1d 1c 12 12 03 00
page 30: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 31: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 32: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 33: 03 07 0a 0c 11 17 08 11 0a 07 04 1d 1c 19 05 04 03 09 0d 00 0d 15 19 05 00 18 0b 09 04 08 08 07
page 34: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 35: 00 11 04 01 01 04 02 13 0f 1e 1c 1e 07 0d 07 12 13 18 15 07 0d 10 00 01 0c 03 16 07 03 05 07 06
page 36: 0e 0b 1e 11 10 0d 0d 1d 18 14 05 12 03 0a 00 15 1e 13 11 07 0d 0e 0d 08 06 17 1d 19 13 00 09 1a
page 37: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 38: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 39: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 3a: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 3b: 09 13 06 1c 1d 16 0d 0f 12 01 0c 10 05 02 18 0b 10 1c 12 08 1e 0b 00 15 03 09 1a 14 00 0d 0c 0f
page 3c: 0b 05 06 15 1c 1a 13 18 04 06 15 00 02 18 06 05 0c 19 00 1b 09 11 0e 03 1d 05 18 1b 0e 1d 01 04
page 3d: 04 05 0b 14 0d 06 0a 09 04 12 0e 0a 00 1c 01 03 09 18 1d 17 06 1a 01 03 03 11 12 13 1d 17 17 05
page 3e: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

```
page 3f: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 40: 1c 05 03 19 13 06 0b 09 0d 0d 0c 18 19 11 0e 08 17 1e 07 15 15 14 00 11 06 06 11 13 13 17 15 0e
page 41: 1c 13 02 19 16 1c 05 17 01 14 08 07 1b 03 10 1a 07 06 1b 0d 16 00 0b 05 14 02 1d 00 16 00 07 19
page 42: 19 09 0c 0e 1a 17 1e 05 18 09 11 10 11 09 02 00 1c 1b 0e 02 19 0f 0e 13 04 06 19 16 1e 0d 1e 1b
page 43: 1c 06 17 15 18 0d 0e 0a 0e 07 05 0e 05 0e 11 09 05 12 1a 06 13 14 1b 15 09 06 19 09 00 1a 06 09
page 44: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 45: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 46: 11 15 07 16 0b 1a 0e 14 11 10 0e 1d 17 0d 0f 1b 17 14 1d 03 12 13 0e 1d 1d 0c 13 17 15 0b 18 0a
page 47: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 48: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 49: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 4a: 04 0d 0c 16 1e 1d 10 0d 08 01 00 0e 09 0b 1b 10 11 07 00 0a 04 0f 1e 14 05 1b 18 16 1c 17 18 0a
page 4b: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 4c: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 4d: 5e 02 7f 43 90 7f 30 c0 7f f5 2d 7f 7f 7f 7f 47 7f 38 2e 7f 7f 68 79 37 0f c6 7f fb e0 7f 7f 54
page 4e: 0d 0d 18 05 01 12 1d 19 14 09 1c 01 07 18 1b 0c 1c 03 12 02 07 05 00 0c 0f 08 14 01 10 10 0c 1c
page 4f: 0c 0d 1e 0c 0e 0b 06 06 10 19 02 1d 14 01 15 0c 0f 03 0f 10 18 12 15 16 06 00 0e 04 04 09 10 13
page 50: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 51: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 52: 18 14 0c 1a 02 13 0c 10 1a 18 13 09 07 0e 07 08 1d 03 19 0b 0b 09 02 0e 05 0d 09 1b 1c 0d 13 1c
page 53: 0c 0f 1e 19 0c 1c 11 0c 14 18 1b 14 14 0c 01 0e 03 1d 0b 12 16 05 19 0a 02 12 0c 1c 0d 02 00 00
page 54: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 55: 7f 7f 7f 7f 0b f8 7f 92 36 76 7f 6d aa 40 7f 7f 7f 7f 74 14 42 60 7f 4d 49 67 7f 58 7f 63 64 05
page 56: 13 0b 17 0f 04 12 0a 10 04 07 08 14 00 0c 0c 1b 03 0f 19 0c 1d 07 0f 09 08 02 18 14 19 0e 05 14
page 57: 02 0c 0e 1a 08 1c 19 00 0f 10 13 1b 06 19 00 19 08 00 19 1e 14 18 0c 07 14 19 08 0b 08 08 1a 00
page 58: 1b 06 04 18 07 03 0f 05 06 08 02 19 11 14 09 18 1d 1e 01 09 02 0e 14 12 0a 1d 13 1e 0d 13 03 10
page 59: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 5a: 01 19 06 12 05 01 17 0f 12 15 12 0c 09 10 07 08 19 0a 16 15 0e 18 0a 00 1a 17 16 1c 0c 0d 12 1b
page 5b: 1b 14 19 00 1d 16 12 1c 1b 03 19 17 06 17 12 05 18 04 12 0d 07 11 0e 06 1d 02 00 0f 19 14 17 0f
page 5c: 1a 17 1b 00 00 07 00 12 1c 1b 03 14 14 14 0c 07 1b 1c 16 10 01 08 07 07 06 14 15 05 1b 00 1d 12
page 5d: 06 11 00 00 13 16 1a 17 04 16 1e 14 0e 09 01 13 1d 03 19 1b 0a 1a 04 09 11 1b 10 02 1c 11 18 07
page 5e: 4e 94 5d 7f 7f bb 7f 7f 50 7f ce 7f d6 ab 7f 10 1b 7f 7f 7f 7f da 89 75 7f 7f 55 ca 7f 65 62 bd
page 5f: 02 0e 15 18 14 1e 16 0c 19 12 12 12 17 15 0e 18 0d 16 1c 10 04 1c 06 06 01 0d 0c 19 05 0b 17 00
page 60: 1b 19 05 15 1a 17 08 15 0c 0d 16 14 04 13 01 06 19 1c 07 17 05 0f 0a 02 0d 11 1a 03 08 00 06 08
page 61: 1d 07 00 05 14 06 1d 02 1b 0a 1c 0a 03 14 09 1d 19 07 0f 11 17 08 11 10 12 11 0d 0c 0c 1e 10 03
page 62: 19 19 12 01 06 03 13 10 05 1d 1e 1b 0e 09 06 19 15 08 1b 11 0c 0c 16 0e 14 03 15 08 1c 06 0a 10
page 63: 04 10 1a 0a 17 12 0c 1e 0c 0e 13 09 19 12 12 10 1e 1e 1a 0e 0c 10 01 03 1e 03 1d 15 1c 02 09 18
page 64: 11 17 15 1b 12 00 03 0c 03 09 08 1e 1d 14 0d 0c 02 0e 04 10 19 0c 15 19 1c 0d 07 1b 0f 08 15 1a
page 65: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 66: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 67: 10 18 08 00 1b 06 0c 03 12 0e 06 01 0a 18 04 07 13 13 18 13 1a 04 1c 00 03 03 18 0f 1c 1e 1d 13
page 68: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 69: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 6a: a1 52 66 7f c3 0a 4f bc 7f 93 6b 06 ec 7f e3 53 07 09 7a 7f b3 7f db 73 48 7f 08 e7 7f 6e 86 56
page 6b: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 6c: 1a 1e 08 13 1b 0b 12 06 1a 0d 0f 14 09 19 0e 0d 16 14 15 1b 19 0c 13 1a 01 14 10 0c 03 08 17 1b
```

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page 6d: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 6e: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 6f: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 70: 12 10 08 04 08 13 15 15 00 18 15 15 10 1a 1d 12 0d 10 18 14 18 09 12 07 11 00 10 16 1c 0f 1b 06
page 71: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 72: 0e 15 0c 1e 18 11 04 0d 00 12 1b 05 0f 0e 0c 16 1d 15 0e 1d 0a 17 14 17 1a 06 13 0c 14 1e 13 00
page 73: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 74: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 75: 19 02 16 10 10 08 17 19 17 09 16 02 15 00 00 03 14 1e 0e 13 12 1a 1e 19 0a 02 1b 08 17 1a 05 06
page 76: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 77: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 78: 03 11 02 14 0d 04 09 14 0e 1d 0b 0a 1c 12 03 18 0b 1d 13 18 1b 0f 1d 00 0a 19 00 14 1e 16 1a 02
page 79: 61 7f 8d 33 5c e4 7d 04 7f 7f 7f 15 e2 20 2a 0d 7f 7f 4a 27 3d 3c 7f 26 7f 7f 7f 19 6a 18 7f 7f
page 7a: f9 87 8a ea de d5 a7 cd 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f 7f
page 7b: 04 17 16 0e 10 0f 1c 0f 19 0a 1b 1b 0e 11 1c 16 0f 06 0a 15 05 1c 08 1c 09 1d 15 0f 10 14 12 09
page 7c: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 7d: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 7e: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
page 7f: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
--------------------------------------------------------------------------------------------------------------

disk 00: 1d 1d 06 08 05 00 0e 10 1b 0e 05 0d 04 01 0c 19 02 1e 1a 1e 12 09 17 04 10 19 10 17 05 1a 04 0a
disk 01: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 02: 03 13 06 1a 18 07 10 15 04 15 01 00 12 0c 13 04 1b 0c 18 1b 08 06 0c 10 1e 0d 05 18 1b 1c 1b 09
disk 03: 0d 03 1d 10 05 16 0f 11 06 1d 1b 1b 19 1d 07 18 0c 06 16 0f 07 10 0c 12 17 17 08 0b 07 1d 1e 07
disk 04: 18 1a 0b 0e 11 09 0a 0b 08 15 11 03 03 17 0e 1a 16 12 07 12 0e 17 07 1e 1d 1e 0b 06 0d 17 14 00
disk 05: 0d 0a 11 04 10 16 0c 02 12 09 1c 09 05 0f 0b 02 12 09 1c 04 03 0f 17 1d 15 1c 0f 17 0c 0f 17 01
disk 06: 19 11 13 0a 01 10 0f 05 19 01 1a 1c 03 1d 1d 0a 0d 19 01 19 00 13 01 0e 15 10 0b 08 02 08 06 07
disk 07: 1e 17 12 04 14 10 16 01 14 1d 18 14 06 13 15 07 1c 08 01 0e 1c 15 08 0c 1b 1d 0d 0f 08 14 1b 0a
disk 08: 01 1b 18 10 1d 19 16 0b 16 0a 0a 05 00 18 18 1a 0c 15 12 08 0d 03 19 15 01 15 15 01 1e 1e 0f 0b
disk 09: 0b 0d 08 1d 09 02 01 01 0d 00 0d 1c 08 15 10 05 0d 00 0d 03 03 0e 0b 05 04 08 1d 1d 09 00 0e 1b
disk 0a: 15 17 07 04 09 16 03 15 1d 08 07 12 1a 06 01 0d 0c 03 18 01 14 08 03 0b 0c 0a 13 0e 09 06 12 1a
disk 0b: 1e 16 11 19 0b 0a 08 04 17 11 14 18 0d 0e 0f 07 1b 17 08 07 1a 08 0d 06 0f 04 09 02 13 13 08 1b
disk 0c: 0a 03 0c 16 08 0f 01 1b 1e 11 07 0e 0d 00 02 03 16 1a 0c 0a 02 0f 14 08 1b 1d 07 1b 14 0c 0d 0a
disk 0d: 11 16 09 00 01 0a 0b 1c 15 1b 17 15 17 06 17 12 13 0f 0d 1a 18 05 1a 10 01 18 1b 0d 0d 08 06 10
disk 0e: 13 14 06 09 14 1d 03 16 1a 16 1e 07 05 1e 0e 15 10 11 00 02 02 1a 02 0b 04 13 14 18 16 17 05 0d
disk 0f: 00 1a 01 02 0b 00 1c 00 02 0f 0c 17 1a 00 1d 02 0b 07 05 02 18 0a 0a 1b 0c 04 04 0b 01 14 0b 15
disk 10: 10 17 15 1d 12 0b 1a 1e 1e 03 14 04 08 18 1b 12 09 0f 09 08 06 1d 1c 05 1a 17 16 07 10 19 15 1c
disk 11: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 12: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 13: 04 06 1d 12 0f 18 14 1e 0a 10 1c 09 1c 0b 0e 0c 03 0a 15 1a 11 01 12 14 13 08 01 10 07 19 1a 02
disk 14: 00 1a 1d 11 1e 1b 0c 12 09 17 1a 0d 0f 11 10 0d 10 0b 0c 05 1d 0c 14 0b 06 1c 14 19 11 06 02 1a
disk 15: 06 08 01 0c 0f 02 0a 14 18 17 01 0b 0a 08 1e 11 13 08 0a 1b 14 19 11 01 1d 04 06 0c 13 12 0f 15
disk 16: 14 10 1c 14 02 1d 0b 19 1e 0e 18 18 01 13 18 19 00 10 0d 1c 02 0a 0d 10 07 06 16 1c 0a 12 0c 06
disk 17: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 18: 0c 03 16 09 18 11 16 16 0b 15 01 1a 16 1c 0a 05 16 05 1b 0a 1a 02 08 19 02 16 0c 11 05 07 1b 16
disk 19: 08 10 09 1d 02 0f 13 18 0e 13 04 08 1a 00 10 1c 1c 05 1e 0e 04 19 10 1e 03 1a 09 01 04 18 1c 16
```

```
disk 1a: 15 18 0a 0b 0e 04 1c 01 15 19 17 01 06 00 18 14 1d 03 19 0a 14 1e 08 16 03 00 0c 04 17 11 07 03
disk 1b: 18 03 02 14 1c 02 19 0f 14 19 03 01 1c 04 14 0c 05 02 0c 0d 03 10 16 00 09 16 1a 15 0d 0e 0c 04
disk 1c: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 1d: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 1e: 12 02 1c 1c 15 02 08 04 0c 1a 02 02 0b 0f 06 0e 18 0e 0c 16 15 0d 1a 17 16 11 05 16 17 13 12 10
disk 1f: 14 0a 13 02 17 0c 17 1b 03 1a 1d 07 14 1a 01 14 09 0e 05 0c 1b 08 0c 04 0b 06 0b 0c 10 13 13 00
disk 20: 12 1b 11 10 0b 0f 16 1a 0a 14 0a 07 01 0c 12 0f 0d 17 0e 15 11 1d 0a 0d 17 09 18 0a 04 10 11 09
disk 21: 0b 1b 0a 07 02 16 1c 0d 04 17 1a 0c 0e 0b 10 14 1c 0a 1d 13 0e 1a 07 10 1c 19 1a 10 13 18 07 1d
disk 22: 06 18 03 0a 01 09 03 19 06 0b 1a 02 15 00 1b 05 1a 0a 15 16 0c 06 0f 12 01 02 18 01 06 06 17 00
disk 23: 0c 19 16 1b 00 1e 0c 1d 17 0f 0e 1b 1b 0c 1d 1e 14 04 0b 0e 00 12 09 1c 09 01 1e 19 13 0e 0e 10
disk 24: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 25: 19 0f 15 1c 15 1d 1a 06 13 00 13 1b 16 1b 11 18 07 08 02 04 18 03 17 08 1a 1e 01 11 14 0e 00 0f
disk 26: 1d 09 07 0b 17 0b 1c 0a 1a 1e 04 12 10 18 0f 01 17 14 16 02 1e 05 08 0e 0f 0a 1a 0c 18 1a 08 03
disk 27: 17 0f 06 16 0a 18 05 00 18 04 1a 12 0d 01 18 00 13 0a 13 02 10 0d 01 00 06 11 00 03 04 12 1d 05
disk 28: 01 00 16 00 1e 00 0a 11 1b 06 07 1e 15 03 17 03 0d 15 08 1a 01 04 14 1e 13 14 14 0b 0b 15 02 1e
disk 29: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 2a: 0b 0c 1e 1e 19 14 18 1a 06 13 1e 05 0d 0b 1a 0e 04 0b 14 10 00 19 08 01 13 14 12 02 00 16 0f 00
disk 2b: 0c 1a 1c 0a 14 0a 12 09 1b 01 0e 0b 17 03 02 0d 15 02 11 0b 16 1e 03 1c 10 16 07 07 1b 16 1c 11
disk 2c: 14 06 0e 0f 02 02 00 03 0d 1e 15 11 13 19 1c 00 16 03 18 07 13 17 1a 17 1b 15 16 0a 07 0c 06 03
disk 2d: 12 10 0f 06 0b 1b 07 1b 16 04 10 0e 12 1c 04 1e 1e 1b 1d 09 07 0f 0d 1e 15 14 1b 1d 0d 0a 0d 07
disk 2e: 0a 0a 0e 1c 11 11 09 0a 0e 18 1b 19 06 1c 09 0a 0e 03 10 1d 03 1d 0c 07 10 02 0a 17 09 16 08 17
disk 2f: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 30: 06 14 1e 05 11 01 12 0d 0b 1c 0e 0d 18 1c 05 04 1e 15 17 1e 1d 12 06 15 0c 14 0e 0e 11 16 0c 17
disk 31: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 32: 18 16 1c 16 14 13 07 17 19 07 0b 0d 16 02 03 1c 17 0c 05 00 04 1b 02 1a 05 18 07 15 17 10 07 0f
disk 33: 07 02 07 18 1b 18 1b 1c 10 0b 04 1a 0c 13 06 0c 00 0c 03 0e 1e 14 0a 02 03 14 00 1e 08 13 06 16
disk 34: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 35: 1b 03 02 0f 10 00 0d 04 05 17 00 06 0f 19 18 0f 0f 19 10 18 0d 03 1c 06 11 14 0f 0b 01 0d 02 10
disk 36: 09 0b 02 04 07 1c 1c 08 1d 04 14 03 11 1e 16 15 14 19 0f 1b 16 16 07 18 1d 01 0d 15 19 19 09 0e
disk 37: 19 10 09 1c 01 13 17 19 01 13 09 14 01 0e 0f 08 08 16 11 0b 0e 13 12 15 1c 1e 04 0e 11 03 08 05
disk 38: 00 15 13 09 12 0d 00 07 1e 0a 03 1d 19 06 00 06 15 1d 0a 01 06 1b 03 04 1e 0c 04 14 1e 04 1d 17
disk 39: 0d 0e 1a 02 1d 1c 0d 1e 18 15 10 16 11 18 07 0d 08 00 15 12 07 19 16 17 12 09 14 07 10 19 0f 1a
disk 3a: 11 09 0d 1b 1b 19 1d 1e 00 08 02 19 04 18 05 06 0a 1b 07 05 18 08 11 0e 15 0f 07 04 1a 07 07 11
disk 3b: 0c 08 0e 02 19 07 02 04 0a 0a 13 0a 06 0e 0f 0f 0b 10 1e 0b 15 0d 16 0c 18 1e 16 17 01 15 15 04
disk 3c: 15 06 0c 16 08 13 01 15 07 0d 1e 18 05 18 0c 0f 08 05 1e 0c 06 18 03 0c 03 01 1e 0f 14 04 0b 01
disk 3d: 06 13 11 0c 12 03 1c 0a 0a 1b 12 1e 18 17 1d 15 01 11 0e 10 1e 1e 16 19 00 0d 0e 07 1c 00 1a 1e
disk 3e: 12 1d 00 08 1b 01 15 09 07 01 08 0b 14 19 12 04 10 1c 07 15 06 09 10 19 10 05 11 01 16 11 0a 13
disk 3f: 15 16 13 05 1d 01 06 03 14 0e 1e 05 02 00 09 19 0b 10 09 08 16 00 11 1d 09 0f 13 08 05 1a 00 07
disk 40: 07 15 0f 1e 06 0e 17 1b 09 18 07 06 14 1e 19 01 0d 17 17 19 00 02 0f 07 13 15 0d 00 0c 11 0f 04
disk 41: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 42: 04 10 00 05 0a 0e 0b 08 1d 03 04 17 09 1a 1a 0f 13 0b 17 1e 13 0b 1c 00 17 1d 07 13 03 0c 1d 02
disk 43: 12 08 00 05 1c 18 03 18 15 09 12 08 1a 00 04 0f 10 10 16 0e 09 1d 03 0c 0f 1a 02 1e 0e 00 09 0f
disk 44: 00 12 0b 12 1e 04 09 10 16 05 1a 0b 00 1e 0b 04 12 17 0a 08 12 15 10 14 17 05 1d 17 10 02 09 12
disk 45: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 46: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 47: 08 10 1a 19 13 16 00 04 00 0d 0f 00 19 10 16 1d 17 17 13 10 17 18 09 18 04 10 1c 06 1b 0f 16 04
```

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disk 48: 0d 0c 02 15 0f 06 17 00 1b 10 19 0f 04 0e 06 11 00 15 18 11 0a 14 0c 1d 1c 0d 18 07 1c 14 00 13
disk 49: 0e 06 03 0f 0a 1a 03 02 0a 10 16 13 07 02 14 03 18 13 1b 0d 0e 13 03 1a 12 15 02 08 04 0a 0b 1c
disk 4a: 1c 10 03 15 1d 14 06 12 13 13 09 11 0d 16 04 16 1c 0d 08 07 0a 13 10 05 0e 07 06 0b 15 0d 07 00
disk 4b: 18 05 1d 1a 05 1c 08 1a 06 1a 1a 11 15 17 13 0a 17 1c 10 1a 0b 0d 15 09 18 18 06 0c 1b 0f 01 19
disk 4c: 0f 12 16 05 12 12 1e 0c 06 07 15 18 09 19 1c 0b 02 1c 07 1e 0c 0f 0d 02 0b 02 0f 03 12 10 1c 19
disk 4d: 05 04 17 02 07 04 0b 05 05 14 09 09 1b 10 1d 04 13 0a 00 04 00 12 01 1e 03 11 0b 1c 02 10 02 09
disk 4e: 19 06 0f 0e 02 18 06 16 07 17 1d 02 07 16 07 07 0c 15 1a 13 05 0e 01 14 16 06 00 14 18 1c 00 1b
disk 4f: 18 0c 15 1e 08 13 1e 09 19 02 14 10 17 10 15 03 1a 10 15 17 0f 1a 16 07 02 16 1b 0a 09 14 1d 13
disk 50: 11 07 1a 0d 02 08 19 0d 16 06 0e 0c 0f 15 1a 0e 00 1b 1c 17 0c 1e 1b 1c 0c 12 05 06 0e 09 03 00
disk 51: 07 09 14 03 12 10 08 11 04 0e 0b 05 0c 1c 19 0f 18 16 0f 06 08 0c 03 12 0f 14 00 1c 14 11 09 16
disk 52: 03 0a 1d 11 0f 14 03 04 0c 0b 0e 11 02 08 19 17 13 01 14 02 06 07 1e 0a 09 03 0c 18 0a 0d 03 04
disk 53: 14 06 17 0d 0c 05 12 15 18 19 0a 10 13 0c 00 16 1b 0e 1c 01 12 0c 13 0b 16 06 08 0c 0c 0c 1d 0f
disk 54: 0e 07 18 10 04 1d 1b 02 0b 14 19 1b 0c 02 19 11 01 0c 18 13 14 1d 17 1a 0e 16 14 1d 1b 19 06 08
disk 55: 10 0f 13 00 03 11 14 04 10 08 1d 14 19 18 18 1c 05 02 0e 09 09 03 1c 05 13 02 00 1d 0a 14 03 07
disk 56: 0c 1b 0f 18 14 1c 0b 0a 1a 13 0d 19 06 06 11 18 0c 00 12 1b 12 00 0a 1e 09 15 04 13 0f 01 1e 06
disk 57: 06 03 1a 1e 06 1b 02 1d 03 05 16 11 0e 18 1d 19 06 19 1d 17 13 1e 0d 1c 18 17 0e 0a 19 0a 03 06
disk 58: 0e 02 03 0e 19 02 1c 00 1d 09 0d 0f 0c 08 0e 0f 11 0b 05 12 01 03 0a 10 02 1d 16 0e 11 0a 00 1b
disk 59: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 5a: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 5b: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 5c: 08 15 14 0f 18 06 0f 08 15 1e 18 0f 00 06 04 07 1d 18 10 02 07 13 18 16 12 1c 0f 02 09 07 1b 19
disk 5d: 12 18 13 17 0a 10 00 0a 1d 02 09 00 17 14 0f 0f 1d 14 0a 1a 19 0e 0b 13 11 0b 0b 05 09 14 1a 04
disk 5e: 16 09 07 09 1e 18 05 07 14 0f 07 04 07 09 08 09 13 18 11 0a 05 02 1e 06 13 0a 02 14 12 01 14 1c
disk 5f: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 60: 0e 00 15 00 12 1b 10 0c 16 06 1b 00 1c 01 1b 0d 10 09 16 1d 04 10 04 18 01 0a 06 16 06 1b 18 03
disk 61: 16 06 02 0c 18 09 12 15 05 11 04 18 0e 1b 0d 0c 0d 0d 18 09 00 14 04 04 0a 0e 07 1c 09 1c 08 00
disk 62: 1b 06 01 19 13 1a 1a 03 08 1a 11 18 1c 00 07 02 07 0c 1c 06 0f 0d 1d 14 0c 02 08 03 1e 09 05 00
disk 63: 0d 1d 10 0c 03 16 0d 17 1d 09 0c 16 1b 1c 0b 07 13 19 1a 07 0c 10 07 02 10 07 11 09 0f 1c 03 09
disk 64: 05 07 15 13 0a 19 0d 08 0e 06 17 1d 16 11 02 1d 1b 19 16 02 09 0f 12 06 1b 0f 16 1b 07 06 11 03
disk 65: 0c 19 13 19 1b 14 1b 00 1c 0f 0f 07 09 11 0b 00 0a 04 1e 02 16 17 1e 16 16 13 1b 1a 0f 1d 11 0c
disk 66: 1b 0b 12 01 01 12 08 0b 04 1e 18 1a 0a 03 04 1c 0e 06 1c 1b 06 18 05 03 06 14 0e 0b 17 06 17 16
disk 67: 0b 02 02 03 0c 0e 1c 18 1c 05 01 11 0d 13 1a 16 14 01 17 01 1a 09 09 0c 1d 09 17 1e 03 10 02 03
disk 68: 1a 03 02 0f 0d 18 02 17 1c 18 0a 13 0c 06 06 09 08 12 10 0e 14 00 13 02 1e 12 0f 04 15 1e 0a 14
disk 69: 1c 0c 05 06 00 0f 1e 0b 10 04 17 0b 08 19 15 11 16 04 15 11 13 0a 0d 02 0e 0e 11 0f 12 11 1e 04
disk 6a: 1a 0e 11 0c 15 06 0a 16 0a 1e 0e 00 0f 1a 05 0d 11 1b 00 16 02 15 1d 13 00 08 0e 1b 0d 07 17 16
disk 6b: 08 02 19 07 15 19 14 01 07 05 0d 1b 09 00 1e 13 08 16 0b 1a 19 16 07 19 16 0f 0b 1b 12 0b 15 06
disk 6c: 1c 08 07 16 0a 12 0c 1c 13 1a 10 11 18 1a 17 0d 13 16 06 03 13 08 16 00 15 01 00 05 0a 03 12 1a
disk 6d: 0e 19 09 1e 0b 1b 18 12 0b 07 0d 1a 14 14 0b 09 16 04 03 11 1c 00 04 11 0b 18 11 11 01 0a 08 0e
disk 6e: 14 15 0a 00 07 1c 0c 0e 09 00 11 02 19 11 03 06 01 05 09 0b 0c 01 1d 0c 1e 05 14 1a 0c 17 08 15
disk 6f: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 70: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 71: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 72: 1e 0c 1d 12 00 01 05 1e 05 1b 16 1c 13 07 18 00 0a 0a 18 0d 04 04 05 0c 10 00 1e 12 08 12 1e 04
disk 73: 17 17 00 07 03 1e 06 04 16 18 16 10 1b 12 01 19 00 1e 11 13 07 1a 0b 11 01 14 1a 13 19 11 11 19
disk 74: 15 00 0d 01 1b 14 17 12 03 10 19 06 17 03 08 0e 01 0b 10 10 1b 18 07 1b 11 18 03 0c 0a 0f 1b 02
disk 75: 03 08 17 07 0c 05 1e 18 0b 1e 1b 09 02 16 13 08 00 08 1c 15 14 15 08 1b 0e 1c 12 15 1b 1e 16 1d
```

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disk 76: 0f 15 13 1e 01 10 1a 0c 01 0c 12 1d 05 07 08 05 0c 1a 0f 08 1d 0e 05 17 04 14 01 11 17 08 0b 16
disk 77: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 78: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
disk 79: 08 17 16 03 0c 1b 13 01 02 0f 1c 18 1d 08 06 18 0d 1c 15 09 1d 01 1d 1c 12 04 06 01 0f 01 19 0f
disk 7a: 16 1a 0e 18 0a 05 09 07 08 1d 02 17 08 0c 1e 12 13 19 01 0a 03 1a 15 1a 11 02 0e 1a 1d 1a 01 1c
disk 7b: 10 02 11 18 1c 03 16 03 13 10 00 05 0c 15 1e 08 08 15 0e 12 1a 17 0d 0b 15 12 14 0f 16 07 19 0c
disk 7c: 0c 06 06 0e 11 15 0e 1d 0c 00 10 14 07 17 06 1c 0d 1d 13 16 06 1b 1e 04 11 04 1b 1a 1c 17 0c 13
disk 7d: 06 03 13 16 1b 14 05 0c 11 17 1a 1c 1c 14 14 0d 15 0b 1b 09 10 0a 10 14 07 0e 11 15 12 16 03 0d
disk 7e: 0d 08 02 08 10 08 0b 16 0f 02 02 1a 05 0c 15 1e 10 17 13 18 0e 06 10 13 04 12 0e 0b 0f 0b 0b 1e
disk 7f: 0f 16 0d 11 08 05 19 15 09 0c 11 02 13 1e 15 0e 03 10 12 15 1b 08 03 1e 10 1b 12 1b 12 16 13 1d
```

六、（10 分）给出下面程序 fork-example.cpp 的输出结果；

```
====================fork-example.cpp==========================

#include <stdio.h>
#include <sys/types.h>
#include <unistd.h>
#include <string.h>
#include <stdlib.h>

int globalVariable = 20;

int main(void)
{
   char sIdentifier[20];
   int   iStackVariable = 20;

   pid_t pID = fork();
   if (pID == 0)              // child
   {
      strcpy(sIdentifier, "Child Process: ");
      globalVariable++;
      iStackVariable--;
   }
   else if (pID < 0)          // failed to fork
   {
      printf("Failed to fork\n");
      exit(1);
      // Throw exception
   }
   else                              // parent
```

```
    {
        strcpy(sIdentifier, "Parent Process:");
    }

    globalVariable++;
    iStackVariable--;
    printf("%s",sIdentifier);
    printf(" Global variable: %d", globalVariable);
    printf(" Stack variable: %d\n", iStackVariable);
}
============================================================
```