

# POLITECNICO DI TORINO



**Politecnico  
di Torino**

## OSSES LAB #5—Heartbeat moniton

Department of CONTROL AND COMPUTER ENGINEERING (DAUIN)

Master's degree in Mechatronic Engineering

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Operating systems for embedded systems— Prof. Violante

Laboratory 05

Wednesday, 18 January 2024

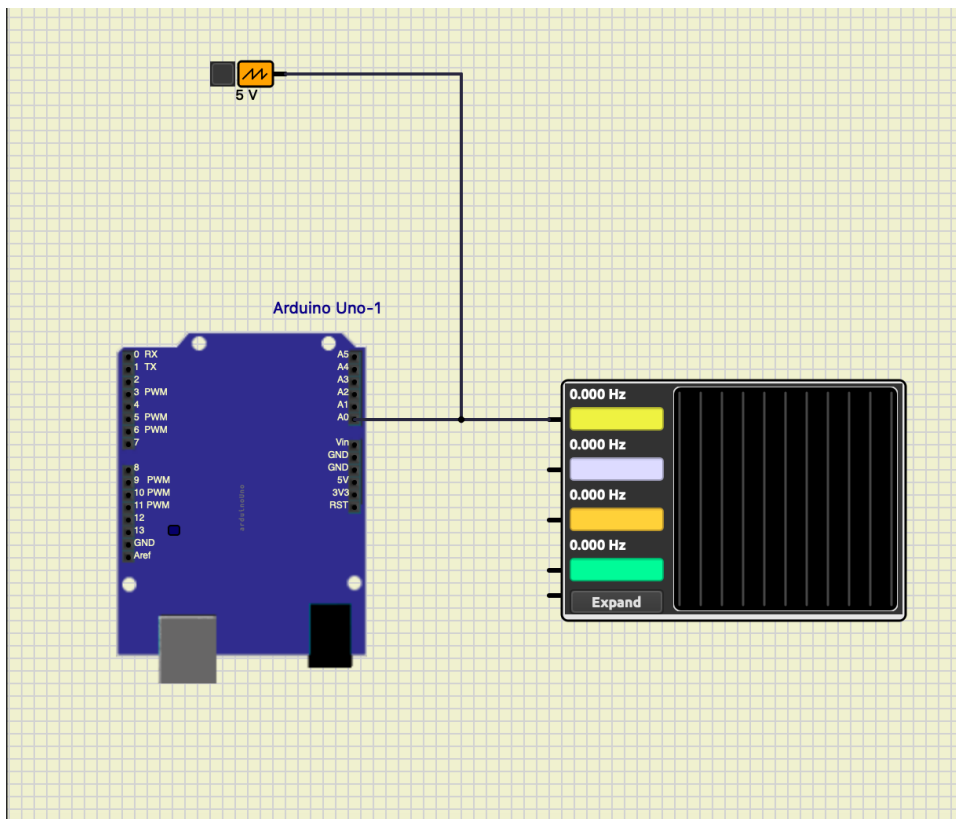
Student:

s320296 DI MARTINO GIULIO

## Exercise

A heartbeat sensor has to be implemented on Arduino Uno, as follows:

- The PPG sensor is simulated on Simulide using a waveform generator with these settings:
  - Id:WaveGen-16
  - Voltage:5V
  - Frequency:1Hz.
  - Trianglewaveshape.
- The signal coming from waveform generator has to be sampled with a frequency of 50 Hz. From the signal is asked to the student to:
  - Convertthesignalinaproperformat.
  - Collectthedatainabuffer.
  - Implementacircularbuffer.
- Once filled the buffer, every 50 samples a task is activated. This task must:
  - Findthepeaksinthebuffer.
  - Calculatethepeak-to-peakdistance(RR).
  - CalculatethepunctualHeartRateas $HR=60/RR$ .
  - PrinttheHeartRatevalueusingtheserialport.
- The Simulide scheme to build-up is the follow:



## C-Code

```
##include "tpl_os.h"
#include "Arduino.h"
#include "tpl_com.h"

DeclareAlarm(a20msec);
DeclareAlarm(a1000msec);

#define K 137

int circularBuffer[K];
static int itemCount = 0;
static int queue = 0;

void setup()
{
    pinMode(A0, INPUT);
    Serial.begin(115200); //115200 bps, 8N1
}

// la task s deve essere attivata ogni 50 Hz = 20 ms
TASK(TaskS) {
    GetResource(Sem);

    int sensorValue = analogRead(A0);
    Serial.print("itemCount: ");
    Serial.print(itemCount);
    Serial.print(" A0: ");
    Serial.print(sensorValue);
    Serial.print("\t");

    Serial.print("head:");
    Serial.println(itemCount%K);
    Serial.print("\t\t");

    circularBuffer[itemCount%K] = sensorValue;

    itemCount++;

    if(itemCount%K==queue%K)
        queue++;
    Serial.print("queue: ");
    Serial.print(queue%K);
    Serial.print("\n");
    ReleaseResource(Sem);
}

TASK(TaskD) {

    static int i;
    static int RR=0;
    static int HR;
    static int Max=0;
    static int Min=0;
    static int T;
    static int index;

    GetResource(Sem);

    Max=circularBuffer[0];
    Min=circularBuffer[0];

    if(itemCount > K)
        T=K;
    else
        T=itemCount;

    for (i=0;i<T;i++) {

        index=(queue+i)%K;
```

```

        Serial.print("data:\t ");
        Serial.print(index);
        Serial.print("\n");

        if (circularBuffer[index]>Max)

            Max=circularBuffer[index];

        if (circularBuffer[index]<=Min)

            Min=circularBuffer[index];
    }

    RR=Max-Min;
    Serial.print("\nRR:");
    Serial.print(RR);
    HR=60*100/RR;
    Serial.print("\nHR%:");
    Serial.print(HR);
    Serial.print("\n");
    ReleaseResource(Sem);
}

```

I define the circular buffer dimension  $K=134$  because 1 Hz correspond to 60 bpm, the e lower heart rate value is 45 bpm that correspond to 0.75 Hz that correspond to 1333.3 ms. To have a sample I need 20 ms so to the circular buffer must have the dimension of 133.3 that is big enough to contain enough to contain at least 2 consecutive beats. I chose 134 because is an integer number. After the simulation I notice that the perfect value for  $K = 137$  because there is a discrepancy due to Arduino

```

TASK(TaskS) {
    GetResource(Sem);
    Serial.print("itemCount: ");
    Serial.print(itemCount);
    Serial.print("\t");
    Serial.println(itemCount%K);
    int sensorValue = analogRead(A0);
    int item=itemCount%K;
    Serial.print("head:");

    Serial.print("\t");

    circularBuffer[itemCount%K] = sensorValue;

    itemCount++;

    if(itemCount%K==queue%K)
        queue++;
    Serial.print("queue: ");
    Serial.print(queue%K);
    Serial.print("\n");
    ReleaseResource(Sem);
}

```

This task is the task that sample the data and send this data to the circular buffer I use two variable `itemCount` and `queue` for implement the circular buffer correctly:

- **Circular Buffer Management:** The modulo operation ensures a circular behavior for the buffer. The head index, represented by **itemCount % K**, is printed to the serial monitor for tracking purposes. The system also increments **itemCount** to manage the circular buffer's insertion index.
- **Queue Management:** The code introduces a mechanism to manage a "queue," denoted by the variable **queue**. If the current index in the circular buffer (**itemCount % K**) is equal to

the queue index (**queue % K**), the queue index is incremented. This mechanism likely serves to handle the circular buffer as a queue.

```
TASK(TaskD) {

    static int i;
    static int RR=0;
    static int HR;
    static int Max=0;
    static int Min=0;
    static int T;
    static int index;

    GetResource(Sem);

    Max=circularBuffer[0];
    Min=circularBuffer[0];

    if(itemCount > K)
        T=K;
    else
        T=itemCount;

    for (i=0;i<T;i++) {

        index=(queue+i)%K;

        Serial.print("data: ");
        Serial.print(index);

        if (circularBuffer[index]>Max)

            Max=circularBuffer[index];

        if (circularBuffer[index]<=Min)

            Min=circularBuffer[index];
    }

    RR=Max-Min;
    Serial.print("\nRR:");
    Serial.print(RR);
    HR=60*100/RR; // percent value
    Serial.print("\nHR%:");
    Serial.print(HR);
    Serial.print("\n");
    ReleaseResource(Sem);
}
```

This task is useful to check each item in the circular buffer and find the max and the min after that I find the peak-to-peak distance RR and the punctual Heart Rate

```
if(itemCount > K)
    T=K;
else
    T=itemCount;
```

With this part I check if the circular buffer has been filled once because if it's the first run is useless to check each value of the buffer

OIL\_FILE:

```
OIL_VERSION = "2.5" : "test" ;

CPU test {
    OS config {
        STATUS = STANDARD;
```

```

BUILD = TRUE {
    TRAMPOLINE_BASE_PATH = "../../../";
    APP_NAME = "lab51";
    APP_SRC = "lab5.1.cpp";
    CPPCOMPILER = "avr-g++";
    COMPILER = "avr-gcc";
    LINKER = "avr-gcc";
    ASSEMBLER = "avr-gcc";
    COPIER = "avr-objcopy";
    SYSTEM = PYTHON;
    LIBRARY = serial;
};
SYSTEM_CALL = TRUE;
};

APPMODE stdAppmode {};

RESOURCE Sem{
RESOURCEPROPERTY = STANDARD;
};

ALARM a20ms {
    COUNTER= SystemCounter;
    ACTION = ACTIVATETASK {TASK = TaskS; };
    AUTOSTART = TRUE {ALARMTIME = 20;CYCLETIME = 20;APPMODE = stdAppmode; };
};

ALARM a1000ms {
    COUNTER= SystemCounter;
    ACTION = ACTIVATETASK {TASK = TaskD; };
    AUTOSTART = TRUE {ALARMTIME = 976;CYCLETIME = 976;APPMODE = stdAppmode; };
};

TASK TaskS {
    PRIORITY = 2;
    AUTOSTART = TRUE { APPMODE = stdAppmode;};
    ACTIVATION = 1;
    SCHEDULE = FULL;
    RESOURCE= Sem;
};

TASK TaskD {
    PRIORITY = 1;
    AUTOSTART = FALSE;
    ACTIVATION = 1;
    SCHEDULE = FULL;
    RESOURCE= Sem;
};

};

```

I use two task with periodicity of 20 ms and 1000 ms the task D run each 1000 ms because I need that the Task S sample 50 data.

## SIMULATION

-1HZ

ItemCount: 0 AB: 1	head0	queue: 0	ItemCount: 40 AB: 368	head:40	queue: 0	ItemCount: 54 AB: 259	head:54	queue: 0	ItemCount: 95 AB: 67	head:95	queue: 0
ItemCount: 1 AB: 43	queue: 0	head:1	ItemCount: 41 AB: 376	head:41	queue: 0	ItemCount: 55 AB: 301	head:55	queue: 0	ItemCount: 96 AB: 25	head:96	queue: 0
ItemCount: 2 AB: 85	queue: 0	head:2	ItemCount: 42 AB: 284	head:42	queue: 0	ItemCount: 56 AB: 343	head:56	queue: 0			
ItemCount: 3 AB: 127	queue: 0	head:3	ItemCount: 43 AB: 242	head:43	queue: 0	ItemCount: 57 AB: 385	head:57	queue: 0	data: 0		
ItemCount: 4 AB: 168	queue: 0	head:4	ItemCount: 44 AB: 200	head:44	queue: 0	ItemCount: 58 AB: 427	head:58	queue: 0	data: 2		
ItemCount: 5 AB: 218	queue: 0	head:5	ItemCount: 45 AB: 158	head:45	queue: 0	ItemCount: 59 AB: 469	head:59	queue: 0	data: 3		
ItemCount: 6 AB: 252	queue: 0	head:6	ItemCount: 46 AB: 117	head:46	queue: 0	ItemCount: 60 AB: 511	head:60	queue: 0	data: 4		
ItemCount: 7 AB: 294	queue: 0	head:7	ItemCount: 47 AB: 75	head:47	queue: 0	ItemCount: 61 AB: 553	head:61	queue: 0	data: 5		
ItemCount: 8 AB: 336	queue: 0	head:8	ItemCount: 48 AB: 33	head:48	queue: 0	ItemCount: 62 AB: 595	head:62	queue: 0	data: 6		
ItemCount: 9 AB: 378	queue: 0	head:9				ItemCount: 63 AB: 637	head:63	queue: 0	data: 7		
ItemCount: 10 AB: 420	queue: 0	head:10	data: 1			ItemCount: 64 AB: 678	head:64	queue: 0	data: 8		
ItemCount: 11 AB: 462	queue: 0	head:11	data: 2			ItemCount: 65 AB: 720	head:65	queue: 0	data: 9		
ItemCount: 12 AB: 504	queue: 0	head:12	data: 3			ItemCount: 66 AB: 762	head:66	queue: 0	data: 10		
ItemCount: 13 AB: 546	queue: 0	head:13	data: 4			ItemCount: 67 AB: 804	head:67	queue: 0	data: 11		
ItemCount: 14 AB: 588	queue: 0	head:14	data: 5			ItemCount: 68 AB: 846	head:68	queue: 0	data: 12		
ItemCount: 15 AB: 629	queue: 0	head:15	data: 6			ItemCount: 69 AB: 888	head:69	queue: 0	data: 13		
ItemCount: 16 AB: 671	queue: 0	head:16	data: 7			ItemCount: 70 AB: 930	head:70	queue: 0	data: 14		
ItemCount: 17 AB: 713	queue: 0	head:17	data: 8			ItemCount: 71 AB: 972	head:71	queue: 0	data: 15		
ItemCount: 18 AB: 755	queue: 0	head:18	data: 9			ItemCount: 72 AB: 1014	head:72	queue: 0	data: 16		
ItemCount: 19 AB: 797	queue: 0	head:19	data: 10			ItemCount: 73 AB: 989	head:73	queue: 0	data: 17		
ItemCount: 20 AB: 839	queue: 0	head:20	data: 11			ItemCount: 74 AB: 947	head:74	queue: 0	data: 18		
ItemCount: 21 AB: 881	queue: 0	head:21	data: 12			ItemCount: 75 AB: 905	head:75	queue: 0	data: 19		
ItemCount: 22 AB: 923	queue: 0	head:22	data: 13			ItemCount: 76 AB: 864	head:76	queue: 0	data: 20		
ItemCount: 23 AB: 965	queue: 0	head:23	data: 14			ItemCount: 77 AB: 822	head:77	queue: 0	data: 21		
ItemCount: 24 AB: 1007	queue: 0	head:24	data: 15			ItemCount: 78 AB: 780	head:78	queue: 0	data: 22		
ItemCount: 25 AB: 997	queue: 0	head:25	data: 16			ItemCount: 79 AB: 738	head:79	queue: 0	data: 23		
ItemCount: 26 AB: 955	queue: 0	head:26	data: 17			ItemCount: 80 AB: 696	head:80	queue: 0	data: 24		
ItemCount: 27 AB: 913	queue: 0	head:27	data: 18			ItemCount: 81 AB: 654	head:81	queue: 0	data: 25		
ItemCount: 28 AB: 871	queue: 0	head:28	data: 19			ItemCount: 82 AB: 612	head:82	queue: 0	data: 26		
ItemCount: 29 AB: 829	queue: 0	head:29	data: 20			ItemCount: 83 AB: 570	head:83	queue: 0	data: 27		
ItemCount: 30 AB: 787	queue: 0	head:30	data: 21			ItemCount: 84 AB: 528	head:84	queue: 0	data: 28		
ItemCount: 31 AB: 745	queue: 0	head:31	data: 22			ItemCount: 85 AB: 486	head:85	queue: 0	data: 29		
ItemCount: 32 AB: 703	queue: 0	head:32	data: 23			ItemCount: 86 AB: 445	head:86	queue: 0	data: 30		
ItemCount: 33 AB: 661	queue: 0	head:33	data: 24			ItemCount: 87 AB: 403	head:87	queue: 0	data: 31		
ItemCount: 34 AB: 619	queue: 0	head:34	data: 25			ItemCount: 88 AB: 361	head:88	queue: 0	data: 32		
ItemCount: 35 AB: 577	queue: 0	head:35	data: 26			ItemCount: 89 AB: 319	head:89	queue: 0	data: 33		
ItemCount: 36 AB: 536	queue: 0	head:36	data: 27			ItemCount: 90 AB: 277	head:90	queue: 0	data: 34		
ItemCount: 37 AB: 494	queue: 0	head:37	data: 28			ItemCount: 91 AB: 235	head:91	queue: 0	data: 35		
ItemCount: 38 AB: 452	queue: 0	head:38	data: 29			ItemCount: 92 AB: 193	head:92	queue: 0	data: 36		
ItemCount: 39 AB: 410	queue: 0	head:39	data: 30			ItemCount: 93 AB: 151	head:93	queue: 0	data: 37		
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ItemCount: 105 AB: 665	head:105	data: 79	
ItemCount: 106 AB: 633	queue: 0	data: 80	
ItemCount: 106 AB: 633	head:106	data: 81	
ItemCount: 107 AB: 602	queue: 0	data: 82	
ItemCount: 107 AB: 602	head:107	data: 83	
ItemCount: 108 AB: 571	queue: 0	data: 84	
ItemCount: 108 AB: 571	head:108	data: 85	
ItemCount: 109 AB: 539	queue: 0	data: 86	
ItemCount: 109 AB: 539	head:109	data: 87	
ItemCount: 110 AB: 508	queue: 0	data: 88	
ItemCount: 110 AB: 508	head:110	data: 89	
ItemCount: 111 AB: 476	queue: 0	data: 90	
ItemCount: 111 AB: 476	head:111	data: 91	
ItemCount: 112 AB: 445	queue: 0	data: 92	
ItemCount: 112 AB: 445	head:112	data: 93	
ItemCount: 113 AB: 413	queue: 0	data: 94	
ItemCount: 113 AB: 413	head:113	data: 95	
ItemCount: 114 AB: 382	queue: 0	data: 96	
ItemCount: 114 AB: 382	head:114	data: 97	
ItemCount: 115 AB: 351	queue: 0	data: 98	
ItemCount: 115 AB: 351	head:115	data: 99	
ItemCount: 116 AB: 319	queue: 0	data: 100	
ItemCount: 116 AB: 319	head:116	data: 101	
ItemCount: 117 AB: 288	queue: 0	data: 102	
ItemCount: 117 AB: 288	head:117	data: 103	
ItemCount: 118 AB: 256	queue: 0	data: 104	
ItemCount: 118 AB: 256	head:118	data: 105	
ItemCount: 119 AB: 225	queue: 0	data: 106	
ItemCount: 119 AB: 225	head:119	data: 107	
ItemCount: 120 AB: 193	queue: 0	data: 108	
ItemCount: 120 AB: 193	head:120	data: 109	
ItemCount: 121 AB: 162	queue: 0	data: 110	
ItemCount: 121 AB: 162	head:121	data: 111	
ItemCount: 122 AB: 131	queue: 0	data: 112	
ItemCount: 122 AB: 131	head:122	data: 113	
ItemCount: 123 AB: 99	queue: 0	data: 114	
ItemCount: 123 AB: 99	head:123	data: 115	
ItemCount: 124 AB: 68	queue: 0	data: 116	
ItemCount: 124 AB: 68	head:124	data: 117	
ItemCount: 125 AB: 36	queue: 0	data: 118	
ItemCount: 125 AB: 36	head:125	data: 119	
ItemCount: 126 AB: 5	queue: 0	data: 120	
ItemCount: 126 AB: 5	head:126	data: 121	
ItemCount: 127 AB: 25	queue: 0	data: 122	
ItemCount: 127 AB: 25	head:127	data: 123	
ItemCount: 128 AB: 57	queue: 0	data: 124	
ItemCount: 128 AB: 57	head:128	data: 125	
ItemCount: 129 AB: 88	queue: 0	data: 126	
ItemCount: 129 AB: 88	head:129	data: 127	
ItemCount: 130 AB: 120	queue: 0	data: 128	
ItemCount: 130 AB: 120	head:130	data: 129	
ItemCount: 131 AB: 151	queue: 0	data: 130	
ItemCount: 131 AB: 151	head:131	data: 131	
ItemCount: 132 AB: 182	queue: 0	data: 132	
ItemCount: 132 AB: 182	head:132	data: 133	
ItemCount: 133 AB: 214	queue: 0	data: 134	
ItemCount: 133 AB: 214	head:133	data: 135	
ItemCount: 134 AB: 245	queue: 0	data: 136	
ItemCount: 134 AB: 245	head:134	data: 0	
ItemCount: 135 AB: 277	queue: 0	data: 1	
ItemCount: 135 AB: 277	head:135	data: 2	
ItemCount: 136 AB: 308	queue: 0	data: 3	
ItemCount: 136 AB: 308	head:136	data: 4	
ItemCount: 137 AB: 340	queue: 1	data: 5	
ItemCount: 137 AB: 340	head:0	data: 6	
ItemCount: 138 AB: 371	queue: 2		
ItemCount: 138 AB: 371	head:1	RR:1005	
ItemCount: 139 AB: 402	queue: 3	RR:5	
ItemCount: 139 AB: 402	head:2	ItemCount: 143 AB: 703	head:6
ItemCount: 140 AB: 434	queue: 4	ItemCount: 144 AB: 717	queue: 8
ItemCount: 140 AB: 434	head:3		head:7
ItemCount: 141 AB: 465	queue: 5	ItemCount: 145 AB: 748	queue: 9
ItemCount: 141 AB: 465	head:4		head:8
ItemCount: 142 AB: 497	queue: 6	ItemCount: 146 AB: 780	queue: 10
ItemCount: 142 AB: 497	head:5		head:9
	queue: 7	ItemCount: 147 AB: 811	queue: 11
			head:10
data: 7		ItemCount: 148 AB: 842	queue: 12
data: 8			head:11
data: 9			queue: 13
data: 10			



ItemCount: 0 AB: 4	head:0	ItemCount: 39 AB: 814	head:39	ItemCount: 61 AB: 385	queue: 0	data: 36
ItemCount: 1 AB: 129	queue: 0	ItemCount: 40 AB: 948	head:40	ItemCount: 62 AB: 268	head:61	data: 37
ItemCount: 2 AB: 255	head:1	ItemCount: 41 AB: 979	queue: 0	ItemCount: 63 AB: 134	queue: 0	data: 38
ItemCount: 3 AB: 381	queue: 0	ItemCount: 42 AB: 854	head:41	ItemCount: 64 AB: 8	head:62	data: 39
ItemCount: 4 AB: 506	head:2	ItemCount: 43 AB: 728	head:42	ItemCount: 65 AB: 116	queue: 0	data: 40
ItemCount: 5 AB: 632	queue: 0	ItemCount: 44 AB: 602	queue: 0	ItemCount: 66 AB: 242	head:63	data: 41
ItemCount: 6 AB: 758	head:3	ItemCount: 45 AB: 476	head:43	ItemCount: 67 AB: 368	head:64	data: 42
ItemCount: 7 AB: 884	queue: 0	ItemCount: 46 AB: 351	head:44	ItemCount: 68 AB: 493	head:65	data: 43
ItemCount: 8 AB: 1009	head:4	ItemCount: 47 AB: 225	queue: 0	ItemCount: 69 AB: 619	head:66	data: 44
ItemCount: 9 AB: 918	queue: 0	ItemCount: 48 AB: 99	head:45	ItemCount: 70 AB: 745	queue: 0	data: 45
ItemCount: 10 AB: 784	head:5		head:46	ItemCount: 71 AB: 878	head:67	data: 46
ItemCount: 11 AB: 659	queue: 0		head:47	ItemCount: 72 AB: 996	head:68	data: 47
ItemCount: 12 AB: 533	head:6		head:48	ItemCount: 73 AB: 923	queue: 0	data: 48
ItemCount: 13 AB: 407	queue: 0		queue: 0	ItemCount: 74 AB: 797	head:69	data: 49
ItemCount: 14 AB: 281	head:7		head:49	ItemCount: 75 AB: 672	queue: 0	data: 50
ItemCount: 15 AB: 156	queue: 0		head:50	ItemCount: 76 AB: 546	head:70	data: 51
ItemCount: 16 AB: 38	head:8		head:51	ItemCount: 77 AB: 420	head:71	data: 52
ItemCount: 17 AB: 95	queue: 0		head:52	ItemCount: 78 AB: 294	head:72	data: 53
ItemCount: 18 AB: 228	head:9		head:53	ItemCount: 79 AB: 169	queue: 0	data: 54
ItemCount: 19 AB: 346	queue: 0		head:54	ItemCount: 80 AB: 43	head:73	data: 55
ItemCount: 20 AB: 472	head:10		head:55	ItemCount: 81 AB: 82	head:74	data: 56
ItemCount: 21 AB: 597	queue: 0		head:56	ItemCount: 82 AB: 207	head:75	data: 57
ItemCount: 22 AB: 723	head:11		head:57	ItemCount: 83 AB: 333	head:76	data: 58
ItemCount: 23 AB: 849	queue: 0		head:58	ItemCount: 84 AB: 459	head:77	data: 59
ItemCount: 24 AB: 975	head:12		head:59	ItemCount: 85 AB: 584	head:78	data: 60
ItemCount: 25 AB: 945	queue: 0		head:60	ItemCount: 86 AB: 710	head:79	data: 61
ItemCount: 26 AB: 819	head:13		head:61	ItemCount: 87 AB: 836	head:80	data: 62
ItemCount: 27 AB: 693	queue: 0		head:62	ItemCount: 88 AB: 962	head:81	data: 63
ItemCount: 28 AB: 567	head:14		head:63	ItemCount: 89 AB: 958	head:82	data: 64
ItemCount: 29 AB: 442	queue: 0		head:64	ItemCount: 90 AB: 832	head:83	data: 65
ItemCount: 30 AB: 316	head:15		head:65	ItemCount: 91 AB: 706	head:84	data: 66
ItemCount: 31 AB: 190	queue: 0		head:66	ItemCount: 92 AB: 581	head:85	data: 67
ItemCount: 32 AB: 65	head:16		head:67	ItemCount: 93 AB: 455	head:86	data: 68
ItemCount: 33 AB: 68	queue: 0		head:68	ItemCount: 94 AB: 329	head:87	data: 69
ItemCount: 34 AB: 186	head:17		head:69	ItemCount: 95 AB: 203	head:88	data: 70
ItemCount: 35 AB: 311	queue: 0		head:70	ItemCount: 96 AB: 78	head:89	data: 71
ItemCount: 36 AB: 437	head:18		head:71		head:90	data: 72
ItemCount: 37 AB: 563	queue: 0		head:72		head:91	data: 73
ItemCount: 38 AB: 688	head:19		head:73		head:92	data: 74
ItemCount: 39 AB: 814	queue: 0		head:74		head:93	data: 75

ItemCount: 99 AB: 801	head:99	ItemCount: 100 AB: 801	queue: 0
ItemCount: 100 AB: 927	head:100	ItemCount: 101 AB: 927	head:101
ItemCount: 101 AB: 992	queue: 0	ItemCount: 102 AB: 992	head:102
ItemCount: 102 AB: 867	head:103	ItemCount: 103 AB: 867	queue: 0
ItemCount: 104 AB: 741	head:104	ItemCount: 104 AB: 741	head:104

ItemCount: 115 AB: 641	queue: 0	data: 76
ItemCount: 116 AB: 766	head:115	data: 77
ItemCount: 117 AB: 892	queue: 0	data: 78
ItemCount: 118 AB: 1018	head:116	data: 79
ItemCount: 119 AB: 901	queue: 0	data: 80
ItemCount: 120 AB: 776	head:117	data: 81
ItemCount: 121 AB: 650	queue: 0	data: 82
ItemCount: 122 AB: 524	head:118	data: 83
ItemCount: 123 AB: 398	queue: 0	data: 84
ItemCount: 124 AB: 273	head:119	data: 85
ItemCount: 125 AB: 147	queue: 0	data: 86
ItemCount: 126 AB: 21	head:120	data: 87
ItemCount: 127 AB: 183	queue: 0	data: 88
ItemCount: 128 AB: 229	head:121	data: 89
ItemCount: 129 AB: 354	queue: 0	data: 90
ItemCount: 130 AB: 480	head:122	data: 91
ItemCount: 131 AB: 606	queue: 0	data: 92
ItemCount: 132 AB: 732	head:123	data: 93
ItemCount: 133 AB: 857	queue: 0	data: 94
ItemCount: 134 AB: 983	head:124	data: 95
ItemCount: 135 AB: 936	queue: 0	data: 96
ItemCount: 136 AB: 810	head:125	data: 97
ItemCount: 137 AB: 685	queue: 0	data: 98
ItemCount: 138 AB: 559	head:126	data: 99
ItemCount: 139 AB: 433	queue: 0	data: 100
ItemCount: 140 AB: 307	head:127	data: 101
ItemCount: 141 AB: 182	queue: 0	data: 102
ItemCount: 142 AB: 56	head:128	data: 103
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