

DECUS

PROGRAM LIBRARY

DECUS NO.	12-86
TITLE	ORGAN-AA and ORGAN-BA
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DATE	June 27, 1972
SOURCE LANGUAGE	PAL III

ORGAN - AA and ORGAN - BA

1 - Abstract

These programs allow the user to play any melody in the PDP-12, using the keyboard to produce the musical notes, which will be heard in the speaker.

The first version, AA, assigns a key to each note of a 4-octave range, which were named D01 to D05. Thus, the operator can play his melody like if he were at the organ.

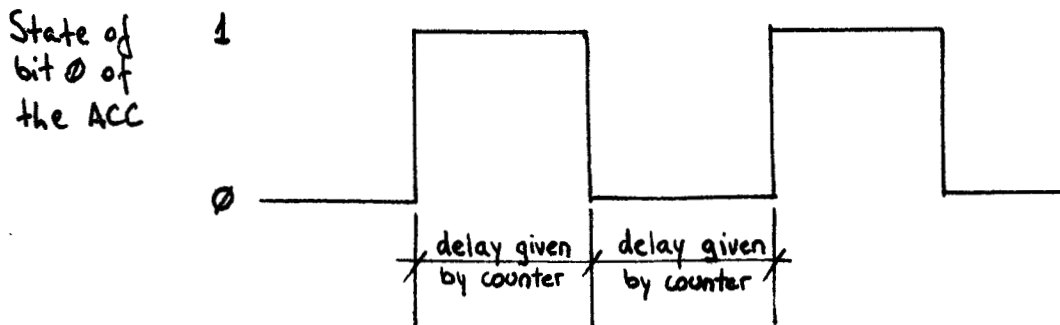
The second version, BA, is a simulation, since the series of notes of a known melody must be first stored in memory. As the operator strikes keys (anyone), the notes are retrieved from the list and played. A consecutive note will be retrieved only when a key is stroke.

In the second version, the operator does not need to know to play the piano - like keyboard, but is supposed to know the melody and the rithm, to strike keys at the proper intervals.

2 - ORGAN - AA - Description

The sound is got in the speaker, which is driven by bit \emptyset of the Accumulator. The musical note depends on the frequency at which bit \emptyset changes its state.

One number has been defined for each musical note. This number is used as a counter to establish a delay between changes of the state of bit \emptyset :



Each time a key is stroke, the program takes the counter from the location pointed by PTR, which corresponds to the character read.

Initially, the program starts with a very low frequency, and then begins to interrogate the keyboard. No two notes can be played simultaneously. Striking "space" will suspend sound until another key is stroke.

3 - Operation ORGAN - AA

Starting address is 0020 in LINC MODE. Almost all keys will be active. See the keys and their corresponding counters in the table beginning in location TAB + 1.

Note that the last octave (DO₄ to DO₂) can be got pressing SHIFT and the numbers 1 to 0, and characters x and =.

"Space" is active too, and is used to suspend sound until a new key is stroke.

To restart, press STOP - L MODE - I/O PRESET - START 20.

4 - Description ORGAN - BA

The table of definitions, which can be found in the first part of the listing of the program, gives for each note a mnemonic name and the correspondent counter.

For execution, the user should place his table of notes, expressed by their mnemonics, beginning in location "TAB". Then he should complete and load the program. The user's table of notes can extend up to location 7777, but normally the melodies should be much shorter.

Location 0017 is used as a pointer to the list of notes. It will point always to the address of the current note.

If the user has stored several different melodies in core, and wants to play one of them skipping the others, he should proceed as follows:

- Place the starting address of the subject list minus one, in location 17.
- Start the program at location 0023.

5 - Operation ORGAN - BA

Starting address: 0020 LINC MODE.

First the program will start with a very low frequency note, and begin to interrogate the keyboard. Each time any key is stroke, a new note (consecutive) will be retrieved from the list and make sound. When the operator strikes "SPACE" bar, the sound will be suspended until another key is stroke.

If the operator knows the melody and rithm well, a very good simulation can be made. It will seem as if the operator were able to play the organ.

NOTE: For both programs: if a rather long modification is introduced, the counters defined here will possibly not be adequate. It should be observed that each counter is a preset value for the instruction ISZ. Once the value PREV is got in the ACC, the program enters a loop ISZ COUNT, JMP.-1. Thus, the COUNT is incremented from the initial value identified with the note, up to 7777. Once this loop has been executed, a half of the cycle of the square wave is completed. Then the program goes again to interrogate the keyboard. After some short routines, it enters again in the ISZ COUNT; JMP.-1 loop to complete the second half of the cycle. Then each half cycle will be composed

by:

- Time required by the routines to interrogate the keyboard, actualize the COUNTER, get the PREVIOUS value, add 4000 to change bit 0, deposit it as PREVIOUS value, etc.

- Time required by the loop ISZ COUNT; JMP.-1.

The counter is got as follows:

$$N = 4095 - \frac{(1000000/Q) - 2L}{9.6}$$

where:

Q: Frequency of the note, in Hz.

L: Length of the accessory routines (those which are always done each time an ISZ COUNT; JMP.-1 loop is executed), in microseconds.

N: Counter, in decimal base.

This counter must be converted to octal base.

==O==

```

0000                                *20
0001                                /ORGAN-AA
0002                                /
0003                                /PLAY THE PDP-12)
0004                                /
0005                                /EACH KEY AT THE KEYBOARD HAS
0006                                /BEEN ASSIGNED TO A MUSICAL NOTE.
0007                                /SEE THE EQUIVALENCES IN THE TABLE
0010                                /BEGINNING IN LOCATION "TAB".
0011                                /THE ORDER IS SUCH AS IN THE PIANO.
0012                                /
0013                                /STRIKE SPACE TO SUSPEND SOUND.
0014                                /
0015                                /STARTING ADDRESS: 20 (LINC MODE)
0016                                /
0017                                /
0020                                0020  0002                                PDP
0021                                PMODE
0022                                *20
0023                                0020  6031  START,  KSF
0024                                0021  5051                                JMP CONTI
0025                                0022  6036  LEER,   KKB
0026                                0023  3110                                DCA HOLD
0027                                0024  1110                                TAD HOLD
0030                                0025  1107                                TAD M240
0031                                0026  7450                                SNA
0032                                0027  5061                                JMP WAIT
0033                                0030  7200                                CLA
0034                                0031  1110                                TAD HOLD
0035                                0032  1105                                TAD M212
0036                                0033  7450                                SNA
0037                                0034  5064                                JMP ESLF
0040                                0035  7200                                CLA
0041                                0036  1110                                TAD HOLD
0042                                0037  1106                                TAD M215
0043                                0040  7450                                SNA
0044                                0041  5071                                JMP ESCR
0045                                0042  7200                                CLA
0046                                0043  1110                                TAD HOLD
0047                                0044  0077                                AND K077
0050                                0045  1114                                TAD PIAB
0051                                0046  3113                                DCA PTR
0052                                0047  2076                                ISZ GAP
0053                                0050  5047                                JMP .-1
0054                                0051  1513  CONTI,  TAD I PTR
0055                                0052  3112                                DCA COUNT
0056                                0053  1111                                TAD PREV
0057                                0054  2112                                ISZ COUNT
0060                                0055  5054                                JMP .-1
0061                                0056  1104                                TAD K4000
0062                                0057  3111                                DCA PREV
0063                                0060  5020                                JMP START
0064
0065                                0061  6031  WAIT,  KSF
0066                                0062  5061                                JMP .-1
0067                                0063  5022                                JMP LEER

```

0070			/		
0071	0064	1101	ESLF,	TAD PTRLF	
0072	0065	3113		DCA PTR	
0073	0066	2076		ISZ GAP	
0074	0067	5066		JMP .-1	
0075	0070	5051		JMP CONTI	
0076			/		
0077	0071	1100	ESCR,	TAD PTRCR	
0100	0072	3113		DCA PTR	
0101	0073	2076		ISZ GAP	
0102	0074	5073		JMP .-1	
0103	0075	5051		JMP CONTI	
0104			/		
0105	0076	0000	GAP,	0	
0106	0077	0077	K077,	077	
0107	0100	0102	PTRCR,	CR	
0110	0101	0103	PTRLF,	LF	
0111	0102	7641	CR,	7641	/CR=D05
0112	0103	7633	LF,	7633	/LF=SI4
0113	0104	4000	K4000,	4000	
0114	0105	7566	M212,	-212	
0115	0106	7563	M215,	-215	
0116	0107	7540	M240,	-240	
0117	0110	0000	HOLD,	0	
0120	0111	0000	PREV,	0	
0121	0112	0000	COUNT,	0	
0122	0113	0000	PTR,	0	
0123	0114	0115	PTAB,	TAB	
0124	0115	0000	TAB,	0	
0125	0116	0000		0	/A
0126	0117	6761		6761	/B=SOL2
0127	0120	6614		6614	/C=MI2
0130	0121	6546		6546	/D=RE*2
0131	0122	7423		7423	/E=LA3
0132	0123	0000		0	/F
0133	0124	6721		6721	/G=FA*2
0134	0125	7016		7016	/H=SOL*2
0135	0126	7557		7557	/I=FA4
0136	0127	7105		7105	/J=LA*2
0137	0130	0000		0	/K
0140	0131	7214		7214	/L=D0*3
0141	0132	7136		7136	/M=SI2
0142	0133	7053		7053	/N=LA2
0143	0134	7577		7577	/O=SOL4
0144	0135	7616		7616	/P=LA4
0145	0136	7332		7332	/Q=FA3
0146	0137	7461		7461	/R=SI3
0147	0140	6424		6424	/S=D0*2
0150	0141	7475		7475	/T=D04
0151	0142	7546		7546	/U=MI4
0152	0143	6657		6657	/V=FA2
0153	0144	7372		7372	/W=SOL3
0154	0145	6477		6477	/X=RE2
0155	0146	7523		7523	/Y=RE4
0156	0147	6350		6350	/Z=D02
0157	0150	0000		0	/E
0160	0151	0000		0	/RUB.
0161	0152	0000		0	/J
0162	0153	0000		0	/I
0163	0154	0000		0	/BK ARR.

0164	0155	0000	0	/SPACE
0165	0156	5045	5045	/!=DO*1
0166	0157	5171	5171	/"=RE1
0167	0160	5311	5311	/NO.SIGN=RE*1
0170	0161	5424	5424	/\$=MI1
0171	0162	5533	5533	/%=FA1
0172	0163	5636	5636	/8=FA*1
0173	0164	5735	5735	/S.QUOTE=SOL1
0174	0165	6031	6031	/(=SOL*1
0175	0166	6121	6121	/)=LA1
0176	0167	6206	6206	/*=LA*1
0177	0170	0000	0	/+
0200	0171	7166	7166	/,=DO3
0201	0172	0000	0	/-
0202	0173	7241	7241	/.=RE3
0203	0174	7310	7310	//=MI3
0204	0175	7607	7607	/0=SOL*4
0205	0176	4713	4713	/1=DO1
0206	0177	7353	7353	/2=FA*3
0207	0200	7411	7411	/3=SOL*3
0210	0201	7445	7445	/4=LA*3
0211	0202	0000	0	/5
0212	0203	7510	7510	/6=DO*4
0213	0204	7535	7535	/7=RE*4
0214	0205	0000	0	/8
0215	0206	7567	7567	/9=FA*4
0216	0207	7624	7624	/:=LA*4
0217	0210	7265	7265	/;=RE*3
0220	0211	0000	0	/<<
0221	0212	6270	6270	/==S I1
0222	0213	0000	0	/>
0223				
0224				

NO ERRORS

CONTI	0051
COUNT	0112
CR	0102
ESCR	0071
ESLF	0064
GAP	0076
HOLD	0110
K077	0077
K4000	0104
LEER	0022
LF	0103
M212	0105
M215	0106
M240	0107
PREV	0111
PTAB	0114
PTR	0113
PTRCR	0100
PTRLF	0101
START	0020
TAB	0115
WAIT	0061

PS 224,267

-

1 LN=224

```
/
/
/
/[!] ["] [ ] [S] [%] [&] [ ] [()] [)] [*] [=]
/DO* RE RE* MI FA FA* SOL SOL* LA LA* SI
/ 1 1 1 1 1 1 1 1 1 1 1
/
/
/[1] [2] [3] [4] [5] [6] [7] [8] [9] [0] [:] [-]
/DO FA* SOL* LA* - DO* RE* - FA* SOL* LA* -
/ 1 3 3 3 4 4 4 4 4 4 4
/
/
/[0] [W] [E] [R] [T] [Y] [U] [I] [O] [P] [LF]
[CR]
/FA SOL LA SI DO RE MI FA SOL LA SI DO
/ 3 3 3 3 4 4 4 4 4 4 4 5
/
/
/
/[A] [S] [D] [F] [G] [H] [J] [K] [L] [;]
/ - DO* RE* - FA* SOL* LA* - DO* RE*
/ 2 2 2 2 2 2 3 3
/
/
/[Z] [X] [C] [V] [B] [N] [M] [.] [.] [/]
/DO RE MI FA SOL LA SI DO RE MI
/ 2 2 2 2 2 2 3 3 3
/
/
```

```

0000      *20
0001      /ORGAN-BA
0002      /
0003      /PROGRAMMED MUSIC FOR THE PDP-12
0004      /
0005      /START 20 LINC MODE
0006      /
0007      /
0010      /PLACE THE TABLE OF NOTES OF THE
0011      /DESIRED MELODY BEGINNING IN TAG
0012      /"TAB". THE CODE FOR EACH NOTE
0013      /CAN BE FOUND IN THE TABLE OF DE-
0014      /FINITIONS.
0015      /LA1 IS 110 HZ
0016      /LA2 IS 220 HZ
0017      /LA3 IS 440 HZ
0020      /LA4 IS 880 HZ
0021      /IN THE PRESENT LISTING, ALL THE
0022      /NOTES AVAILABLE HAVE BEEN PLACED
0023      /IN A TABLE BEGINNING IN LOCATION
0024      /"TAB", IN ASCENDING ORDER.
0025      /WHEN BUILDING YOUR OWN VERSION,
0026      /REMOVE THEM AND PLACE THERE YOUR
0027      /OWN MELODY. THEN COMPIL AND LOAD.
0030      /
0031      /STRIKING ANY KEY AT THE KEYBOARD
0032      /WILL MAKE A CONSECUTIVE NOTE SOUND.
0033      /STRIKING SPACE WILL SUSPEND SOUND
0034      /UNTIL ANOTHER KEY IS STROKE
0035      /
0036      /NOTE THAT THE TIME BETWEEN CONSE-
0037      /CUTIVE NOTES MUST BE GIVEN BY THE
0040      /OPERATOR ,STRIKING KEYS. IF NO KEY
0041      /IS STROKE,THE SAME NOTE REMAINS.
0042      /
0043      /
0044      /TO RESTART: STOP,LINC MODE,I/O PRESET,
0045      /START 20.
0046      /
0047      /
0050      /
0051      DO1=4713
0052      DOS1=5045
0053      REB1=5045
0054      RE1=5171
0055      RES1=5311
0056      MIR1=5311
0057      MI1=5424
0060      FA1=5533
0061      FAS1=5636
0062      SOLB1=5636
0063      SOL1=5735
0064      SOLS1=6031
0065      LAP1=6031
0066      LA1=6121
0067      LAS1=6206

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0070	SIB1=6206
0071	SI1=6270
0072	
0073	D02=6350
0074	D0S2=6424
0075	REB2=6424
0076	RE2=6477
0077	RES2=6546
0100	MIB2=6546
0101	MI2=6614
0102	FA2=6657
0103	FAS2=6721
0104	SOLB2=6721
0105	SOL2=6761
0106	SOLS2=7016
0107	LAB2=7016
0110	LA2=7053
0111	LAS2=7105
0112	SIB2=7105
0113	SI2=7136
0114	D03=7166
0115	D0S3=7214
0116	REB3=7214
0117	RE3=7241
0120	RES3=7265
0121	MIB3=7265
0122	MI3=7310
0123	FA3=7332
0124	FAS3=7353
0125	SOLB3=7353
0126	SOL3=7372
0127	SOLS3=7411
0130	LAB3=7411
0131	LA3=7423
0132	LAS3=7445
0133	SIB3=7445
0134	SI3=7461
0135	D04=7475
0136	D0S4=7510
0137	REB4=7510
0140	RE4=7523
0141	RES4=7535
0142	MIB4=7535
0143	MI4=7546
0144	FA4=7557
0145	FAS4=7567
0146	SOLB4=7567
0147	SOL4=7577
0150	SOLS4=7607
0151	LAB4=7607
0152	LA4=7616
0153	LAS4=7624
0154	SIB4=7624
0155	SI4=7633
0156	D05=7641
0157	

0160	0020	0002		PDP
0161				Pmode
0162				*17
0163	0017	0000	PNOTA,	0
0164	0020	7300		CLA CLL
0165	0021	1067		TAD PTAB
0166	0022	3017		DCA PNOTA
0167	0023	3064		DCA COUNT
0170	0024	3065		DCA PREV
0171	0025	3066		DCA RESET
0172	0026	6031	START,	KSF
0173	0027	5041		JMP CONT1
0174	0030	6036		KRB
0175	0031	1061		TAD M240
0176	0032	7450		SNA
0177	0033	5051		JMP WAIT
0200	0034	7200	START2,	CLA
0201	0035	2063		ISZ GAP
0202	0036	5035		JMP .-1
0203	0037	1417		TAD I PNOTA
0204	0040	3066		DCA RESET
0205	0041	1066	CONT1,	TAD RESET
0206	0042	3064		DCA COUNT
0207	0043	1065		TAD PREV
0210	0044	2064		ISZ COUNT
0211	0045	5044		JMP .-1
0212	0046	1062		TAD K4000
0213	0047	3065		DCA PREV
0214	0050	5026		JMP START
0215			/	
0216			/	
0217	0051	6031	WAIT,	KSF
0220	0052	5051		JMP .-1
0221	0053	6036		KRB
0222	0054	1061		TAD M240
0223	0055	7450		SNA
0224	0056	5051		JMP WAIT
0225	0057	7200		CLA
0226	0060	5034		JMP START2
0227			/	
0230			/	
0231	0061	7540	M240,	-240
0232	0062	4000	K4000,	4000
0233	0063	0000	GAP,	0
0234	0064	0000	COUNT,	0
0235	0065	0000	PREV,	0
0236	0066	0000	RESET,	0
0237	0067	0067	PTAB,	TAB-1
0240	0070	4713	TAB,	DO1.
0241	0071	5045		DO51
0242	0072	5171		RE1
0243	0073	5311		RES1
0244	0074	5424		MI1
0245	0075	5533		FA1
0246	0076	5636		FAS1
0247	0077	5735		SOL1

0250	0100	6031	SOLS1
0251	0101	6121	LA1
0252	0102	6206	LAS1
0253	0103	6270	SI1
0254	0104	6350	DO2
0255	0105	6424	DOS2
0256	0106	6477	RE2
0257	0107	6546	RES2
0260	0110	6614	MI2
0261	0111	6657	FA2
0262	0112	6721	FAS2
0263	0113	6761	SOL2
0264	0114	7016	SOLS2
0265	0115	7053	LA2
0266	0116	7105	LAS2
0267	0117	7136	SI2
0270	0120	7166	DO3
0271	0121	7214	DOS3
0272	0122	7241	RE3
0273	0123	7265	RES3
0274	0124	7310	MI3
0275	0125	7332	FA3
0276	0126	7353	FAS3
0277	0127	7372	SOL3
0300	0130	7411	SOLS3
0301	0131	7423	LA3
0302	0132	7445	LAS3
0303	0133	7461	SI3
0304	0134	7475	DO4
0305	0135	7510	DOS4
0306	0136	7523	RE4
0307	0137	7535	RES4
0310	0140	7546	MI4
0311	0141	7557	FA4
0312	0142	7567	FAS4
0313	0143	7577	SOL4
0314	0144	7607	SOLS4
0315	0145	7616	LA4
0316	0146	7624	LAS4
0317	0147	7633	SI4
0320	0150	7641	DO5
0321	0151	0000	0
0322	0152	0000	0
0323		/	
0324		/	
0325		/SAMPLE MELODY	
0326		/(FROM 9TH. SYMPHONY L.VAN BEETHOVEN)	
0327		/	
0330	0153	6614	MI2
0331	0154	6614	MI2
0332	0155	6657	FA2
0333	0156	6761	SOL2
0334	0157	6761	SOL2
0335	0160	6657	FA2
0336	0161	6614	MI2
0337	0162	6477	RE2

0340	0163	6350	D02
0341	0164	6350	D02
0342	0165	6477	RE2
0343	0166	6614	MI2
0344	0167	6614	MI2
0345	0170	6477	RE2
0346	0171	6477	RE2
0347	0172	6614	MI2
0350	0173	6614	MI2
0351	0174	6657	FA2
0352	0175	6761	SOL2
0353	0176	6761	SOL2
0354	0177	6657	FA2
0355	0200	6614	MI2
0356	0201	6477	RE2
0357	0202	6350	D02
0360	0203	6350	D02
0361	0204	6477	RE2
0362	0205	6614	MI2
0363	0206	6477	RE2
0364	0207	6350	D02
0365	0210	6350	D02
0366	0211	6477	RE2
0367	0212	6614	MI2
0370	0213	6350	D02
0371	0214	6477	RE2
0372	0215	6614	MI2
0373	0216	6657	FA2
0374	0217	6614	MI2
0375	0220	6350	D02
0376	0221	6477	RE2
0377	0222	6614	MI2
0400	0223	6657	FA2
0401	0224	6614	MI2
0402	0225	6477	RE2
0403	0226	6350	D02
0404	0227	6477	RE2
0405	0230	5735	SOL1
0406	0231	6614	MI2
0407	0232	6614	MI2
0410	0233	6657	FA2
0411	0234	6761	SOL2
0412	0235	6761	SOL2
0413	0236	6657	FA2
0414	0237	6614	MI2
0415	0240	6477	RE2
0416	0241	6350	D02
0417	0242	6350	D02
0420	0243	6477	RE2
0421	0244	6614	MI2
0422	0245	6477	RE2
0423	0246	6350	D02
0424	0247	6350	D02
0425	0250	0000	0
0426	0251	0000	0
0427			

NO ERRORS

CONTI	0041
COUNT	0064
DOS1	5045
DOS2	6424
DOS3	7214
DOS4	7510
DO1	4713
DO2	6350
DO3	7166
DO4	7475
DO5	7641
FAS1	5636
FAS2	6721
FAS3	7353
FAS4	7567
FA1	5533
FA2	6657
FA3	7332
FA4	7557
GAP	0063
K4000	0062
LAB1	6031
LAB2	7016
LAB3	7411
LAB4	7607
LAS1	6206
LAS2	7105
LAS3	7445
LAS4	7624
LA1	6121
LA2	7053
LA3	7423
LA4	7616
MIB1	5311
MIB2	6546
MIB3	7265
MIB4	7535
MI1	5424
MI2	6614
MI3	7310
MI4	7546
M240	0061
PNOTA	0017
PREV	0065
PTAB	0067
REB1	5045
REB2	6424
REB3	7214
REB4	7510
RESET	0066
RES1	5311
RES2	6546
RES3	7265
RES4	7535
RE1	5171
RE2	6477
RE3	7241
RE4	7523

SIB1	6206
SIB2	7105
SIB3	7445
SIB4	7624
SI1	6270
SI2	7136
SI3	7461
SI4	7633
SOLB1	5636
SOLB2	6721
SOLB3	7353
SOLB4	7567
SOLS1	6031
SOLS2	7016
SOLS3	7411
SOLS4	7607
SOL1	5735
SOL2	6761
SOL3	7372
SOL4	7577
START	0026
START2	0034
TAB	0070
WAIT	0051