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MARKOV-2 (MARKOV2.BAS). MARKOV SOLUTION OF MULTI-STATE SYSTEM PROBABILITIES

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PAPER: [http://www.philrutherford.com/Conf\\_Papers/markov.pdf](http://www.philrutherford.com/Conf_Papers/markov.pdf)

ORIGINAL REVISION DATE: 10-12-1989

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RUN DATE: 09-11-2020 (DD-MM-YYYY)

RUN TIME: 16:25:35

RUN WITH MMBASIC.EXE ([www.mmbasic.com](http://www.mmbasic.com))

COMPUTES TIME-DEPENDENT, MULTI-STATE PROBABILITIES USING EXPLICIT OR IMPLICIT FINITE DIFFERENCE METHODOLOGY. THE SAMPLE PROBLEM USES DATA FOR A DEISEL GENERATOR TO COMPUTE PROBABILITIES OF BEING IN SIX STATES, STANDBY, OPERATION, TEST, PREVENTIVE MAINTENANCE, FAILURE AND REPAIR.

IF DESIRED, USER CAN EDIT STATE TRANSITION FREQUENCIES VIA THE DATA STATEMENTS AT PROGRAM END. SEE PAPER FOR DERIVATION OF TRANSITION FREQUENCIES.

THE IMPLICIT METHOD IS THE PREFERABLE OPTION. THE EXPLICIT METHOD REQUIRES SHORTER TIME STEPS. A TIME STEP OF 4 HRS OR LESS GIVES STABLE RESULTS THAT COMPARE WELL TO THE IMPLICIT METHOD. A TIME STEP OF 5 HRS OR MORE IS UNSTABLE.

ENTER INITIAL TIME (HRS) ? 0  
ENTER FINAL TIME (HRS) ? 100  
ENTER TIME STEP (HRS) ? 4  
NUMBER OF STATES 6  
ENTER IMPLICIT (I) OR EXPLICIT (E) ? E

\*\*\* EXPLICIT FINITE DIFFERENCE OPTION \*\*\*

\*\*\* LIST OF TRANSITION FREQUENCIES (/HR) \*\*\*

	STANDBY	OPERATION	TEST	P.M.	FAILURE	REPAIR
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STANDBY	0	1.14e-05	0.00137	0.000685	0.0003	0
OPERATION	0.042	0	0	0	0.003	0

TEST	0.45	1.1e-05	0	0.035	0.015	0
P.M.	0.031	1.1e-06	0.027	0	0.0031	0.00125
FAILURE	0	0	0	0	0	0.25
REPAIR	0.075	0	0.0438	0	0.00625	0

\*\*\* RESULTANT SYSTEM STATE PROBABILITIES \*\*\*

	STANDBY	OPERATION	TEST	P.M.	FAILURE	REPAIR	
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T(HR)	Pr( 1)	Pr( 2)	Pr( 3)	Pr( 4)	Pr( 5)	Pr( 6)	Checksum
0	1	0	0	0	0	0	1
4	0.9879509415	4.505056293e-05	0.005413971159	0.003464941542	0.001553885281	0.001571209989	1
8	0.9903674355	8.239757408e-05	0.0006571267946	0.005409303948	0.001335257166	0.002148479002	1
12	0.9822132581	0.0001123188402	0.005685592729	0.007542114433	0.001668302949	0.002778412997	1
16	0.9860626225	0.0001374547707	0.001014098936	0.00851132899	0.001420850677	0.002853644147	1
20	0.9792918426	0.0001573129794	0.005771063217	0.00987197482	0.001716968251	0.003190838167	1
24	0.9837217183	0.0001742969485	0.001240028814	0.01028718565	0.001464381015	0.003112389223	1
28	0.9777518085	0.00018744384	0.005773823099	0.01119998537	0.001738580685	0.003348358526	1
32	0.982385548	0.0001989721513	0.001401284814	0.01130375158	0.00148929426	0.003221149185	1
36	0.9769367679	0.0002076376373	0.005736996184	0.01195521806	0.001747720573	0.003415659642	1
40	0.9815922801	0.0002155083974	0.001527406117	0.01188639806	0.001505014092	0.00327339328	1
44	0.9765171286	0.0002211801046	0.005680724183	0.01238347902	0.001750622309	0.003446865763	1
48	0.9811019225	0.0002265949986	0.001632970545	0.01222126612	0.001515822596	0.003301423189	1
52	0.9763172137	0.000230266899	0.005615215678	0.01262525744	0.001750262701	0.003461783543	1
56	0.9807839058	0.0002340301289	0.001725701183	0.01241467393	0.00152386228	0.003317826688	1
60	0.9762401657	0.0002363670097	0.005545898116	0.01276075596	0.001748177709	0.00346863547	1
64	0.9805653654	0.0002390173261	0.001809876778	0.01252730047	0.001530275159	0.00332816489	1
68	0.9762316286	0.0002404641032	0.005475719478	0.01283573337	0.001745197113	0.003471257308	1
72	0.9804050765	0.0002423627389	0.001887939573	0.01259376495	0.001535693288	0.003335162909	1
76	0.9762608315	0.0002432173046	0.005406283903	0.01287628791	0.001741779845	0.003471599549	1
80	0.9802795308	0.0002446066606	0.001961318539	0.01263381617	0.001540474396	0.003340253474	1
84	0.9763102901	0.0002450685122	0.005338450085	0.0128973008	0.001738182073	0.003470708439	1
88	0.9801752493	0.00024611138	0.002030872857	0.0126587202	0.001544824096	0.003344222137	1
92	0.9763700635	0.0002463141213	0.005272658789	0.01290725516	0.001734546691	0.003469161745	1
96	0.9800844652	0.0002471199245	0.002097137647	0.01267490494	0.001548862258	0.003347510001	1
100	0.9764345105	0.0002471530085	0.005209115759	0.01291098515	0.00173095263	0.003467282986	1

