

vm_stat on MacOS doesn't include CPU stat like the linux vmstat. So using iostat.

iostat -w | ^{x wait} (Runs every 1 second)

① "us" \Rightarrow % of cpu time in user mode increases with running of "man"

Increases further with more instances

" id" \Rightarrow %. of cpu time in idle mode decreases

10.76	517	5.45	b	/	88	2.51	1.97	2.29
				disk0	cpu	load average		
KB/t	tps	MB/s	us	sy	id	1m	5m	15m
4.00	5	0.02	3	2	95	2.51	1.97	2.29
12.80	15	0.19	3	1	96	2.39	1.95	2.28
0.00	0	0.00	4	3	93	2.39	1.95	2.28
4.00	1	0.00	2	1	96	2.39	1.95	2.28
4.00	2	0.01	3	1	96	2.39	1.95	2.28
15.64	44	0.67	5	4	91	2.39	1.95	2.28
6.64	44	0.28	6	5	89	2.36	1.95	2.28
0.00	0	0.00	7	5	88	2.36	1.95	2.28
11.11	135	1.46	9	5	86	2.36	1.95	2.28

18.47	855	15.43	20	3	77	2.19	1.86	2.26
31.93	167	5.20	18	2	80	2.19	1.86	2.26
28.79	178	4.99	19	2	79	2.18	1.87	2.26
20.21	400	7.90	29	3	68	2.18	1.87	2.26
8.42	2414	19.84	33	6	61	2.18	1.87	2.26
12.42	595	7.21	27	3	70	2.18	1.87	2.26
				disk0	cpu	load average		
KB/t	tps	MB/s	us	sy	id	1m	5m	15m
35.86	141	4.95	27	2	72	2.18	1.87	2.26
22.04	419	9.02	29	4	67	2.48	1.94	2.28
32.96	116	3.75	27	4	69	2.48	1.94	2.28
32.75	1439	46.02	27	7	67	2.48	1.94	2.28
42.07	2232	91.72	28	10	62	2.48	1.94	2.28

② The number "free" pages reduce, once the "mem" starts allocating memory.

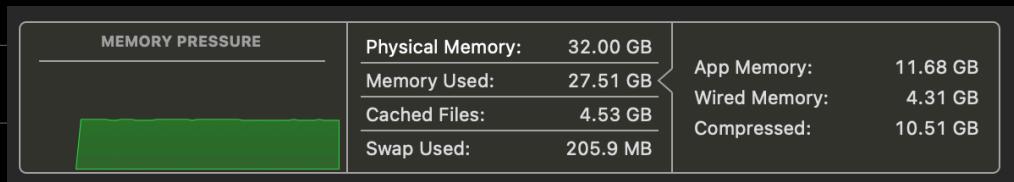
The swapins/swapouts are 0 since the run of ". /mem 1024" doesn't force a swap since RAM has space.

Mac OS prefers to keep inactive pages in RAM.
swap only happens when all free
and inactive memory is exhausted

0	3456	431075	439	429570	0	298354	0	7468	2	1493	6532	0	285038	576046	1879350	878724	4079	3211	42	0
0	3547	431189	354	429936	0	298268	0	12050	2	3493	7021	24	284941	576538	1878613	878596	6110	5842	0	2
0	3072	431747	207	430513	0	298747	0	13350	2	3749	4677	32	284791	577676	1876542	877759	7426	5760	0	3
0	4298	430954	358	429623	0	298301	0	38535	376	2071	18494	4	285023	575912	1878810	878549	19215	22062	192	0
0	3951	429741	438	428183	0	298518	45	16324	377	7407	2691	234	285171	573191	1883192	881256	3382	8283	109	0
0	3814	430447	341	428865	0	297633	415	13539	2	7608	234	93	285076	574577	1882353	881004	2391	1775	32	3

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	5610	424680	377	423120	0	298311	650	5800	2	608	585	22	0	0	0	0	0	0	0	0
0	70237	361002	484	422991	0	297739	654	30287	4758	8667	0	0	0	0	0	0	0	0	0	0
0	55644	384225	522	422816	0	297913	654	49118	1021	6681	0	16	0	0	0	0	0	0	0	0
0	57416	383823	535	422116	0	298877	4	6456	6	1733	0	0	0	0	0	0	0	0	0	0
0	54582	385802	597	421595	0	300640	139	14181	377	7060	4	0	0	0	0	0	0	0	0	0
0	50668	395480	644	421628	0	298358	1046	27122	219	9173	0	0	0	0	0	0	0	0	0	0

vm.swapsusage: total = 1024.00M used = 205.94M free = 818.06M (encrypted)



Processes: 666 total, 2 running, 664 sleeping, 7243 threads
Load Avg: 2.01, 1.65, 1.56 CPU usage: 2.58% user, 2.87% sys, 94.54% idle SharedLibs: 869M resident, 171M data, 111M linkedit.
MemRegions: 0 total, 0B resident, 0B private, 2124M shared. PhysMem: 31G used (4621M wired, 11G compressor), 102M unused.
VM: 471T vsize, 5536M framework vsize, 1734(0) swapins, 14716(0) swapouts. Networks: packets: 21328743/319G in, 13827851/3121M out. Disks: 12544420/240G read, 13659968/180G written.

③ vm_stat |

It doesn't show swapins / swapouts as non-zero, even though swapping is happening.

MacOS does background compression and lazy sweeping.

VMmap shows swapping is happening.
With ".mem 34000" running (32GB Ram)

ReadOnly portion of Libraries: Total=611.7M resident=57.7M(9%) swapped_out_or_unallocated=554.0M(91%)
Writable regions: Total=33.7G written=33.2G(98%) resident=4.6G(14%) swapped_out=28.6G(85%) unallocated=528.8M(2%)

Compressed pages increase, then reduces on stop of program

3450	386895	432	386791	0	306274	0	380366	1	257	10449	0	264906	509212	3895873	957949	193287	209197	0	0
0	0																		
3783	381119	470	379457	0	308327	0	412702	156	601	1741	4	264949	496098	3905880	967442	218381	228388	257	1
0	0																		
336194	121509	457	305713	0	308258	4	95540	4873	4283	9	0	265003	162676	2064733	969809	37216	36956	209	0
0	0																		
332142	127431	457	305585	0	308810	4	11735	156	4783	0	0	265008	168465	2058856	967497	5864	0	6	0
0	0																		
329716	130622	467	305593	0	310935	12	10534	104	2908	0	0	265027	171655	2053669	964609	5159	0	8	0
0	0																		

Free pages reduce

Mach Virtual Memory Statistics: (page size of 16384 bytes)																				
free	active	specul	inactiv	throttle	wired	prgble	faults	copy	0fill	reactive	purged	file-backed	anonymous	cmprssed	cmprssor	dcomprs	comprs	pageins	pageout	swap
4551	424644	122	423386	0	301302	62	679044K	36468989	280047K	117187K	7490372	267006	581146	1947386	888085	81864605	92763495	12222748	480964	1
770	14716																			
3799	425713	115	424452	0	301389	0	15914	4	401	15	62	266999	583281	1944899	886655	9094	6852	0	1	
0	0																			
259332	172711	175	421282	0	301833	284	31010	4702	4409	32	0	267140	327028	1944832	886699	2713	3072	241	0	
0	0																			
256897	177819	184	420223	0	300628	386	7312	217	3045	0	0	267149	331077	1941615	886295	2838	0	14	0	
0	0																			

With ".mem 16000", on loop! more swappedout

==== Summary for process 42338
ReadOnly portion of Libraries: Total=611.7M resident=59.3M(10%) swapped_out_or_unallocated=552.4M(90%)
Writable regions: Total=16.2G written=15.6G(97%) resident=5.0G(31%) swapped_out=10.6G(66%) unallocated=536.7M(3%)

Reduces with subsequent loops, since already in resident mem.

==== Summary for process 42338
ReadOnly portion of Libraries: Total=611.7M resident=59.3M(10%) swapped_out_or_unallocated=552.4M(90%)
Writable regions: Total=16.2G written=15.6G(97%) resident=5.6G(35%) swapped_out=10.0G(62%) unallocated=536.7M(3%)

(4)

".mem 16000"

4.00	3	0.01	4	10	87	1.65	2.17	2.44	
14.49	211	2.99	7	19	74	1.65	2.17	2.44	
6.19	191	1.15	4	10	86	1.65	2.17	2.44	
6.37	222	1.38	4	9	87	1.65	2.17	2.44	
9.96	98	0.95	2	1	96	1.65	2.17	2.44	
6.00	6	0.04	2	1	97	1.60	2.15	2.43	
9.83	35	0.33	6	4	90	1.60	2.15	2.43	
			disk0		cpu	load	average		
			KB/t	tps	MB/s	us	sy	id	
						1m	5m	15m	
9.09	33	0.29		2	2	96	1.60	2.15	2.43
6.10	78	0.46		2	1	97	1.60	2.15	2.43

Jumps in tps,
KB/t, MB/s ⇒
allocation of memory
"sy" too (system calls)
"id" idle less

" .mem 34000 "

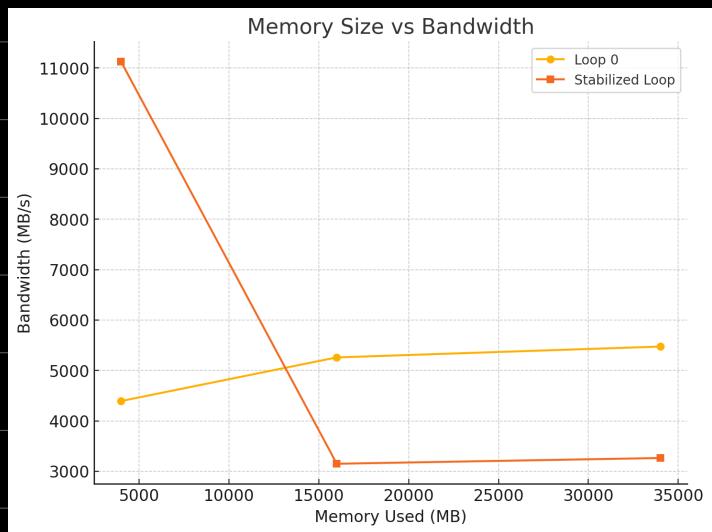
	12.80	15	0.19	2	2	96	1.55	1.62	1.91
	0.00	0	0.00	2	2	96	1.55	1.62	1.91
	10.14	28	0.28	6	3	91	1.55	1.62	1.91
	31.00	12	0.36	7	15	78	1.67	1.64	1.92
	16.00	1	0.02	7	12	81	1.67	1.64	1.92
	52.09	44	2.23	7	13	80	1.67	1.64	1.92
	0.00	0	0.00	7	13	81	1.67	1.64	1.92
	5.08	52	0.26	6	13	81	1.67	1.64	1.92
	5.83	163	0.93	15	17	68	1.70	1.65	1.92
	24.29	28	0.66	8	12	80	1.70	1.65	1.92
	4.87	110	0.52	6	12	82	1.70	1.65	1.92
	31.43	14	0.43	5	11	84	1.70	1.65	1.92
	7.00	20	0.14	4	10	85	1.70	1.65	1.92
	6.47	60	0.38	5	10	84	1.64	1.64	1.91
			disk0		cpu		load	average	
	KB/t	tps	MB/s	us	sy	id	1m	5m	15m
	4.94	51	0.25	4	10	86	1.64	1.64	1.91
	14.34	123	1.72	5	10	85	1.64	1.64	1.91
	0.00	0	0.00	7	13	80	1.64	1.64	1.91
	121.56	18	2.13	5	12	83	1.64	1.64	1.91
	11.44	342	3.82	4	11	86	1.59	1.63	1.91
	10.21	47	0.47	4	10	86	1.59	1.63	1.91
	0.00	0	0.00	4	10	86	1.59	1.63	1.91

(5)

```
allocating 16777216000 bytes (16000.00 MB)
  number of integers in array: 4194304000
loop 0 in 3042.28 ms (bandwidth: 5259.22 MB/s)
loop 1 in 5004.14 ms (bandwidth: 3197.35 MB/s)
loop 2 in 5074.74 ms (bandwidth: 3152.87 MB/s)
loop 3 in 5136.17 ms (bandwidth: 3115.16 MB/s)
loop 4 in 5079.80 ms (bandwidth: 3149.73 MB/s)
```

```
allocating 35651584000 bytes (34000.00 MB)
  number of integers in array: 8912896000
loop 0 in 6210.85 ms (bandwidth: 5474.29 MB/s)
loop 1 in 10356.02 ms (bandwidth: 3283.12 MB/s)
loop 2 in 10719.01 ms (bandwidth: 3171.94 MB/s)
loop 3 in 10310.94 ms (bandwidth: 3297.47 MB/s)
loop 4 in 10417.33 ms (bandwidth: 3263.79 MB/s)
```

```
allocating 4194304000 bytes (4000.00 MB)
  number of integers in array: 1048576000
loop 0 in 910.27 ms (bandwidth: 4394.29 MB/s)
loop 1 in 1341.59 ms (bandwidth: 2981.54 MB/s)
loop 2 in 1283.86 ms (bandwidth: 3115.61 MB/s)
loop 3 in 1277.01 ms (bandwidth: 3132.31 MB/s)
loop 4 in 1129.64 ms (bandwidth: 3540.94 MB/s)
loop 5 in 1010.18 ms (bandwidth: 3959.69 MB/s)
loop 6 in 911.81 ms (bandwidth: 4386.87 MB/s)
loop 7 in 518.86 ms (bandwidth: 7709.25 MB/s)
loop 8 in 367.56 ms (bandwidth: 10882.46 MB/s)
loop 9 in 361.04 ms (bandwidth: 11079.23 MB/s)
loop 10 in 361.58 ms (bandwidth: 11062.44 MB/s)
loop 11 in 357.63 ms (bandwidth: 11184.71 MB/s)
loop 12 in 361.63 ms (bandwidth: 11060.99 MB/s)
loop 13 in 363.73 ms (bandwidth: 10997.08 MB/s)
loop 14 in 363.98 ms (bandwidth: 10989.53 MB/s)
loop 15 in 359.55 ms (bandwidth: 11124.95 MB/s)
```



⑥ Wasn't able to get failure on macOS
Maybe try on Linux later.

```
vm.swapsusage: total = 2048.00M used = 994.56M free = 1053.44M (encrypted)
```

```
ReadOnly portion of Libraries: Total=611.7M resident=60.0M(10%) swapped_out_or_unallocated=551.8M(90%)
Writable regions: Total=39.6G written=39.1G(99%) resident=5.0G(13%) swapped_out=34.0G(86%) unallocated=536.7M(1%)
```

⑦ Again will try on Linux later