Hewlett-Packard Company  
hp AlphaServer GS320 68/1224  

SPECfp_rate2000 = NC  
SPECfp_rate_base2000 = NC  

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<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Base Copies</th>
<th>Base Runtime</th>
<th>Base Ratio</th>
<th>Copies</th>
<th>Runtime</th>
<th>Ratio</th>
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<tbody>
<tr>
<td>168.wupwise</td>
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<td>NC</td>
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<td>32</td>
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<td>171.swim</td>
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<tr>
<td>172.mgrid</td>
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<td>173.applu</td>
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<td>178.galgel</td>
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<td>NC</td>
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<td>179.art</td>
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<tr>
<td>187.facerec</td>
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<tr>
<td>189.lucas</td>
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<tr>
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<td>32</td>
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<tr>
<td>301.apsi</td>
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<td>NC</td>
<td>NC</td>
<td>32</td>
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<td>NC</td>
</tr>
</tbody>
</table>

**Hardware**
- CPU: Alpha 21264C  
- CPU MHz: 1224  
- FPU: Integrated  
- CPU(s) enabled: 32 cores, 32 chips, 1 core/chip  
- CPU(s) orderable: 1 to 32  
- Parallel: No  
- Primary Cache: 64kB(I)+64kB(D) on chip  
- Secondary Cache: 16MB off chip per CPU  
- L3 Cache: None  
- Other Cache: None  
- Memory: 128GB  
- Disk Subsystem: mfs (Memory File System)  
- Other Hardware: None

**Software**
- Operating System: Tru64 UNIX T5.1B  
- Compiler:  
  - Compaq C V6.5-011-48C5K  
  - Spike V5.2 (506-48C5K)  
  - Compaq Fortran V5.5-1877-48BBF  
  - Compaq Fortran 77 V5.5-1877-48BBF  
  - KAP Fortran V4.4 k340504 20010517  
  - KAP Fortran 77 V4.1 k310440 980926  
  - KAP C V4.2 k010737S 010515  
- File System: mfs  
- System State: Multi-user

**Notes/Tuning Information**

Baseline  
C: cc -arch ev6 -fast -O4 ONESTEP  
Fortran: f90 -arch ev6 -fast -O5 ONESTEP

Peak:  
All use -arch ev6 -non_shared ONESTEP (except applu and ammp)
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Notes/Tuning Information (Continued)

Individual benchmark tuning:
168.wupwise: kf77 -call_shared -inline all -tune ev67
-unroll 12 -automatic -align commons -arch ev67
-fkapargs=' -aggressive= -fuse
-fuselevel=1 -so=2 -r=1 -o=1 -interleave
-ur=6 -ur2=060 ' +PFB

171.swim: same as base

172.mgrid: kf90 -call_shared -arch generic -O5 -inline
manual -nopipeline -unroll 9 -automatic -transform_loops
-fkapargs='-aggressive=a -fuse -interleave
-ur=2 -ur3=5 -cachesize=128,16000 ' +PFB

173.applu: kf90 -O5 -transform_loops
-fkapargs=' -o=0 -interleave -ur=14
-ur2=260 -ur3=18 ' +PFB

177.mesa: kcc -fast -O4 +CFB +IFB

178.galgel: f90 -O5 -fast -unroll 5 -automatic

179.art: kcc -assume whole_program -ldensemalloc
-call_shared -assume restricted_pointers
-unroll 16 -inline none -fkapargs=' -fuse -fuselevel=1 -ur=3' +PFB

183.equake: cc -call_shared -arch generic -fast -O4
-ldensemalloc -assume restricted_pointers
-inline speed -unroll 13 -xtaso_short +PFB

187.facerec: f90 -O4 -nopipeline -inline all
-non_shared -speculate all -unroll 7
-automatic -assume accuracy_sensitive
-math_library fast +IFB

188.anmp: cc -arch host -O4 -ifo -assume nomath_errno
-assume trusted_short_alignment -fp_reorder
-readonly_strings -ldensemalloc -xtaso_short
-assume restricted_pointers -unroll 9
-inline speed +CFB +IFB +PFB

189.lucas: kf90 -O5 -fkapargs=' -ur=1 ' +PFB

191.fma3d: kf90 -O4 -transform_loops -fkapargs='-cachesize=128,16000' +PFB

200.sixtrack: f90 -fast -O5 -assume accuracy_sensitive
-notransform_loops +PFB

301.apsi: kf90 -O5 -inline none -call_shared -speculate all
-align commons -fkapargs=' -aggressive=ab
-tune=ev5 -fuse -ur=1 -ur2=60 -ur3=20
-cachesize=128,16000'

Most benchmarks are built using one or more types of profile-driven feedback. The types used are designated by abbreviations in the notes.
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Notes/Tuning Information (Continued)

+CFB: Code generation is optimized by the compiler, using feedback from a training run. These commands are done before the first compile (in phase "fdo_pre0"):

```bash
mkdir /tmp/pp
rm -f /tmp/pp/${baseexe}*
```

and these flags are added to the first and second compiles:

```bash
PASS1_CFLAGS = -prof_gen_noopt -prof_dir /tmp/pp
PASS2_CFLAGS = -prof_use -prof_dir /tmp/pp
```

(Peak builds use /tmp/pp above; base builds use /tmp/pb.)

+IFB: Icache usage is improved by the post-link-time optimizer Spike, using feedback from a training run. These commands are used (in phase "fdo_postN"):

```bash
mv ${baseexe} oldexe
spike oldexe -feedback oldexe -o ${baseexe}
```

+PFB: Prefetches are improved by the post-link-time optimizer Spike, using feedback from a training run. These commands are used (in phase "fdo_post_makeN"):

```bash
rm -f *Counts*
mv ${baseexe} oldexe
pixie -stats dstride oldexe 1>pixie.out 2>pixie.err
mv oldexe.pixie ${baseexe}
```

A training run is carried out (in phase "fdo_runN"), and then this command (in phase "fdo_postN"):

```bash
spike oldexe -fb oldexe -stride_prefetch -o ${baseexe}
```

When Spike is used for both Icache and Prefetch improvements, only one spike command is actually issued, with the Icache options followed by the Prefetch options.

```
vm:
    vm_bigpg_enabled = 1
    vm_bigpg_thresh=16
    vm_swap_eager = 0
```
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Notes/Tuning Information (Continued)

proc:
max_per_proc_address_space = 0x400000000000
max_per_proc_data_size = 0x400000000000
max_per_proc_stack_size = 0x400000000000
max_proc_per_user = 2048
max_threads_per_user = 0
maxusers = 16384
per_proc_address_space = 0x400000000000
per_proc_data_size = 0x400000000000
per_proc_stack_size = 0x400000000000

Portability: galgel: -fixed
submit = runon cpu

Submitted by: "Craig, Steve" <Steve.Craig@hp.com>
Submitted: Mon Sep  9 13:57:45 2002
Submission: cpu2000-20020909-01617.sub