

1. (10 %) What is a shell on operating system? Give two common shell program names?
2. (10 %) What are the advantages of using a window system? What is the unique feature of X window system while comparing with other window system?
3. (15 %) What is the function of the following C routine?

```
xchg(pa,pb)
int *pa, *pb;
{
  *pa ^= *pb;
  *pb ^= *pa;
  *pa ^= *pb;
}
```

Note: $\hat{=}$ \rightarrow bitwise XOR update operator

4. (15 %) What would be the output of the following FORTRAN program and why?

```
PROGRAM TEST
IMPLICIT REAL*8 (A-H,O-Z)
```

```
TEMP=0.3
TEMP=TEMP+0.6
IF (TEMP .EQ. 0.9) PRINT *, 'WORKS!'
PRINT *, 'OVER!'
END
```

5. (15 %) Compare the differences between RS-232 and IEEE-488 communication protocol.
6. (15 %) Explain the operation principles of direct memory access (DMA). Describe in detail a DMA example in personal computer applications.
7. (20 %)
 - (a) Draw the block diagram of a microprocessor-based system to measure the duration of pulse in real time with the resolution better than 1 ms. Explain your measurement algorithm. (Note: no commercial available counter/timer processor can be used in your design)
 - (b) Compare the interrupt with the polling system.