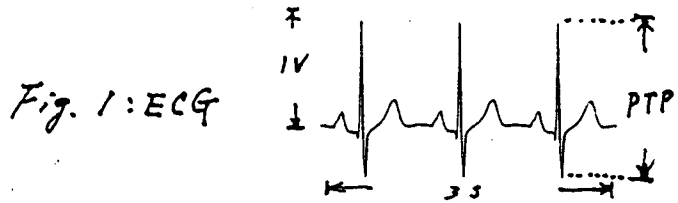1. (20 %) Please compare the differences:

   (a) cache memory vs. register

   (b) RS232 vs. IEEE-488

   (c) run-time error vs. logical error

   (d) primary storage vs. secondary storage

Fig. 1: ECG

2. (20 %) A neurologist in NCKU wishes to implement a microprocessor-based data acquisition system for heart rate (unit: beats/min) from electrocardiograph (ECG,   , as shown in Fig. 1).

   (a) Assumed the desired sampling rate for the microprocessor-based ECG data acquisition system is fixed at 250 Hz using interrupt mode. Please give your system in block diagram and describe your design considerations.
   (Hint: You might need A/D converter, timer/counter, microprocessor, RAM, ..., etc.)

   (b) Please give your algorithm for heart rate measurement in flowchart.
   (Hint: You might use (i) the inverse of heart beat interval or (ii) the heart beats detected at a short interval (e.g. 10 seconds))

3. (10 %) Assumed the ECG signal measured in previous problem is stored in an array. Please write a program (in C, Pascal, or Basic) to measure the peak-to-peak amplitude (as PTP shown in Fig. 1).

4. (20%) Computer software can be roughly divided into two kinds: the system programs and the application programs. The most fundamental of all the system programs is the operating system. Describe what is the operating system and its importance?

5. (15%) What is the INTERNET?

6. (15%) In FORTRAN programming, a variable can be declared as *REAL*8*; likewise in C, variable can be declared as *double*. Describe the advantages and disadvantages of these data types while compared with *REAL* or *float* data types.