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CONDITION-ACTION DIAGRAM FLOWCHARTS. RADIOLOGY SUBSYSTEM.(U)
AUG 76 D HENSON, A L WEIHRER
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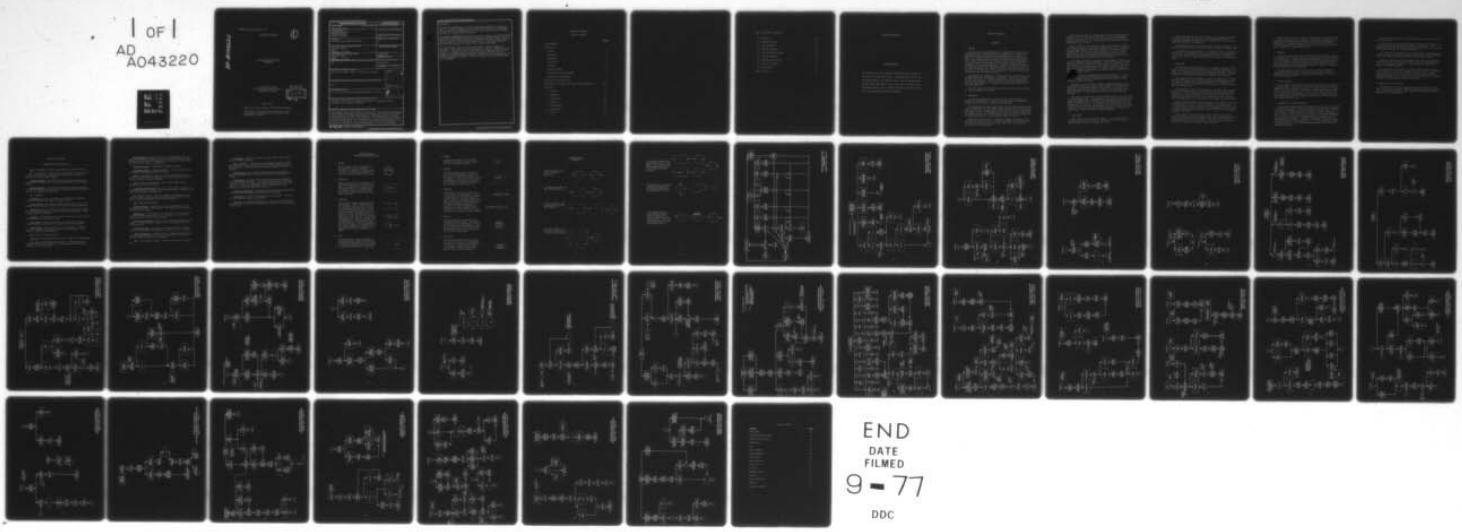

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RADIOLOGY SUBSYSTEM

CONDITION-ACTION DIAGRAM FLOWCHARTS

US ARMY TRIMIS AGENCY
Walter Reed Army Medical Center
Washington, DC 20012

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The purpose of these condition-action diagrams for the Walter Reed Army Medical Center (WRAMC) Department of Radiology is to depict the working relationships, information needs and data flows within the department, and the interfaces between Radiology and the other departments. The diagrams depict the current structure and organizational relationships with specialized personnel roles/activities superimposed (e.g., the commo clerk and exit review function). The diagrams are intended to provide understanding as to how the department

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operates and is subdivided, and why the department operates as it does, in order to see where automation could improve the operation of the department, and the accuracy and timeliness of the radiological procedures from request processing to patient report generation.

The diagrams are WRAMC-specific but may be used by others to see how the WRAMC Department of Radiology is organized. They help illustrate the data which must be collected and the various relationships which exist within a hospital. They are geared to a military environment and to a very large department, although most functions are common to any radiology department.

The overview chart shows the various areas where radiologic support is provided. Mobile exams are given inpatients who cannot be transported to the department. Patients are seen in main diagnostic radiology, the cast room, surgery, the emergency room, and special procedures which are parts of diagnostic radiology although physically separate with their own reception and modified scheduling activities. Radiation therapy and Nuclear Medicine are also diagrammed.

RADIOLOGY SUBSYSTEM

TABLE OF CONTENTS

	Page
Acknowledgments	
Narrative:	
Purpose	1
Background	1
Limitations	2
Objectives	3
Overview	4
Expected Benefits	4
Interfaces w/other Subsystems	4
Amenability to ADP Support	5
Abbreviations and Definitions	6
Condition-Action Diagram Interpretation Guide/Examples	9/11
Flowcharts:	
1. Overview	13
2. Reception	14
3. Appointment	18
4. Schedule	20
5. Order Review	21
6. Examination	22
7. Exit	25

Table of Contents (continued)

8.	Assembly	26
9.	Results Reporting	27
10.	Image Management	28
11.	Radiation Therapy	32
12.	Cast Room/Surgery Report	35
13.	Nuclear Medicine	36
14.	Emergency Room Process	38
15.	Special Procedures	39
16.	Mobile Exam	40
Index to Charts		41

RADIOLOGY SUBSYSTEM

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RADIOLOGY SUBSYSTEM

NARRATIVE

1. PURPOSE

The purpose of these condition-action diagrams for the Walter Reed Army Medical Center (WRAMC) Department of Radiology is to depict the working relationships, information needs and data flows within the department, and the interfaces between Radiology and the other departments. The diagrams depict the current structure and organizational relationships with specialized personnel roles/activities superimposed (e.g., the commo clerk and exit review function). The diagrams are intended to provide understanding as to how the department operates and is subdivided, and why the department operates as it does, in order to see where automation could improve the operation of the department, and the accuracy and timeliness of the radiological procedures from request processing to patient report generation.

The diagrams are WRAMC-specific but may be used by others to see how the WRAMC Department of Radiology is organized. They help illustrate the data which must be collected and the various relationships which exist within a hospital. They are geared to a military environment and to a very large department, although most functions are common to any radiology department.

The charts were used by TRIMIS in developing functional requirements for computer support in Radiology.

2. BACKGROUND

The radiology departments of large military hospitals serve both inpatients and outpatients. Under this system, proper scheduling is a problem and long waits for patients are not uncommon.

The department maintains a film library of more than 200,000 patients. Proper interpretation of radiologic images includes review of past images. Thus, for each exam the image library must check to see if it has pertinent images on file. These images are stored in SSN terminal digit order. In addition, health care providers borrow films for various purposes and the department maintains a large teaching library of films.

Radiology technicians are an expensive resource and improper scheduling of their time is costly. In addition, WRAMC is a training center and records are required to insure each student has received proper instruction in all procedures.

Once patients arrive for examinations, they must be processed and knowledge of their locations made available. In large departments, a patient can easily get lost or wait long periods of time before he notifies someone that he is not being processed or released, or has not reached the proper location.

After an exam has been performed, images are reviewed by Quality Control (QC) personnel and additional views ordered or, if the quality is unacceptable, repeat views may be required. The patient should be retained until this review has been completed so as not to require another visit. For patients requiring special preparation this is especially important, and patients frequently wait in dressing rooms until notified that the exam quality is satisfactory.

The Radiology Department includes not only Diagnostic Radiology but Radiation Therapy and Nuclear Medicine. Radiation Therapy is a treatment type facility. Individuals in this section follow patients over long periods of treatment, keep patient specialty charts, order tests, etc. Their needs are diagrammed and a computer system to support Radiology completely would require a clinical support capability much like other medical clinics.

Nuclear Medicine is responsible for the Thyroid Clinic. In this [illegible], it has clinical functions like Radiation Therapy. It also provides diagnostic services and performs certain nuclear medicine laboratory testing functions.

Radiology has several unique problems. Expensive equipment must be utilized as fully as possible. Human resource utilization must be optimized. The department reviews all requests to see if they are appropriate and many exams require consent of the radiologist prior to being scheduled. This is usually not required in other ancillary services.

Radiological procedures may require administration of contrast media or special preparation. This preparation may interfere with other scheduled radiographic exams. Therefore, the scheduler must consider what exams are scheduled or are to be scheduled and arrange them so that the elapsed time is minimized. In addition, many exams require that the patient not eat so must be scheduled early in the day. These all combine to provide a unique, complicated scheduling problem. Equipment and technicians, as well as patients, require scheduling.

3. LIMITATIONS

These charts do not specify ADP support. They do assume that required staff would be available. They are very much influenced by the environment, policies, and physical layout.

The Nuclear Medicine laboratory function is not diagrammed although it is under the supervision of the Nuclear Medicine service. The laboratory functions are similar to those described in the Laboratory Subsystem (Department of Pathology).

The system described is for a very large radiology department. Some smaller departments may have different needs, problems, and organization.

The diagrams show the influence of a military facility on procedures and policies. DOD requirements may differ slightly from requirements of other health care facilities, particularly in the area of charges for services and payment of such charges, and their influence on information needs.

4. OBJECTIVES

The diagrams were developed to show the information needs, decision points, and flow of paper and patients in a radiology department. They depict the interfaces between patient, health care provider, previous images, and resources necessary to do a diagnostic procedure or provide treatment. They emphasize workload accountability and reporting.

The scheduling function stresses the need for optimum use of equipment and technicians, and yet preserves patient satisfaction and meets the patient's needs while providing exams that can be scheduled to minimize elapsed time, and prevents interference of one exam's preparation with another exam.

The diagrams help identify bottlenecks, or potential ones, to help provide for minimal time in the department by the patient and optimal exam quality. The interpretation must be made by the radiologist who requires all previous images at the time new ones are read. These interpretations should be typed. It is desirable to minimize the time from exam completion to the availability of the report to the physician.

Case conferences require that the recent and past images of a patient be available while the case is under discussion. A large teaching library provides a source of images of previous interesting proven cases of various entities which may assist in the discussion of current cases. It additionally provides an important source of material for training in diagnostic radiology.

Images need to be made available on short notice which requires accurate storage and retrieval capabilities. Since images may be loaned, these loan records are very important. Images from other radiology departments must be received, cataloged, and stored for retrieval; and images may be permanently loaned to other hospitals.

Quality control review of images is required prior to patient release to prevent rescheduling of the patients. The number of retakes and the problems which necessitated the retakes can provide good management information. Film usage requires close monitoring to insure that film usage is commensurate with workload. Excess film usage is indicative of film pilferage or excessive repeat exams.

5. OVERVIEW

The overview chart shows the various areas where radiologic support is provided. Mobile exams are given inpatients who cannot be transported to the department. Patients are seen in main diagnostic radiology, the cast room, surgery, the emergency room, and special procedures which are parts of diagnostic radiology although physically separate with their own reception and modified scheduling activities. Radiation therapy and Nuclear Medicine are also diagrammed.

The system expects all patients to enter the system through the appointment/scheduling module. Those patients who wish to be seen immediately will, if possible, be scheduled immediately but they will be given "an appointment."

6. EXPECTED BENEFITS

The diagrams will show those areas where bottlenecks or potential for bottlenecks exist. They may be used to show those areas which would be impacted by policy changes. They depict the flow of paper and information as well as the flow and interaction of people and thus can be used to trace the impact of changes. They can also be used to define areas that could benefit from ADP support, the type of ADP support required, who would interface with the system, and the point in the process where this interface should occur.

7. INTERFACES WITH OTHER SUBSYSTEMS

The major Radiology Department interface is with health care providers in the wards and clinics. Once it is decided that radiologic treatment or testing is required, a request for services is made either in writing on a request or consultation form, or by direct contact between the patient's health care provider and a member of the Radiology Department's staff. Once the exam has been approved (many do not require approval), it is scheduled; and there is agreement between requestor/ patient/ department on the schedule. Equipment, technicians, and patients must be coordinated into the schedule process. Usually, preparation instructions are provided by the requestor although they may be provided by department personnel.

Pharmacy may be required to supply preparation media and, if so, they will be so advised.

If the patient is to receive treatment, a health care provider in the department may become the patient's primary care physician. Then clinic-like functions are carried out by the department (e.g., requesting lab procedures and patient record maintenance).

Once exams have been performed or treatments given, interim progress notes may be made, or reports of exams or consultations are prepared and sent to the requestor and incorporated in the patient's record.

Logistics interfaces with the department when equipment maintenance is required and for supply requisitioning, although the department does some direct ordering of supplies. A large part of the department's budget is expendable supplies.

The registration of patients is a Patient Administration function and no request for service is provided unless the patient is registered. Since radiology is an ancillary service, it may be the first--and frequently the only--contact the patient has with the system; therefore, Radiology personnel must be able to perform this function (i.e., check eligibility of patients and register the patient).

8. AMENABILITY TO ADP SUPPORT

The diagrams will assist in developing computer support for ADP. They have been used to define order entry, scheduling, patient tracking, exam, patient exit completion, image management, and clinical support modules for the TRIMIS system.

RADIOLOGY SUBSYSTEM

ABBREVIATIONS AND DEFINITIONS

Appt - Appointment; includes the scheduling process (see below).

CP - Care provider - anyone who has contact with a patient or his record; may be limited to those pesons who may request procedures: physicians, nurses, triage corpsmen.

Conflicting exams - Two exams in which the media given for one would prevent the other exams from being performed due to media interference.

Contra-indicators - A condition that makes an exam more critical and special permission may be required or special precautions should be taken; e.g., pregnancy, allergy, etc.

Dx - Diagnosis.

Eligibility for care - Standards set by PAD based on dependency status, ID card expiration date, retirement status.

Escort Service - The patient transportation service used to take patients from one place to another if the patient requires assistance.

Exam Directory - A list (file) of exams which defines valid exams, when they may be scheduled, rooms where they can be performed, length of time (average) to perform.

Handcarry - The delivery by the patient following the exam of both the images and the report on the exam.

Loose Image - An image which is not in a sub-folder or master folder. Usually one which has been separated from its sub-folder.

Master Folder - The patient's total set of images. The master folder (a large envelope usually) does not leave Radiology. This folder is divided into sub-folders.

MTF - Medical treatment facility.

No Shows - Scheduled patients who did not appear for an appointment.

PAD - Patient Administration (registrar). The organizational element responsible for eligibility, patient administration policies, and proper record custodians.

Patient Release - Patients are held in the department until the quality and number of images needed for the exam are approved. Upon completion of the review of images (QC), the patient is released after the last exam for which he is scheduled.

Pre-exam Procedure - Undressing; medication; fasting.

Preliminary Report - (Nuclear Medicine) A report prepared prior to review by the department staff conference.

Prep - Preparation for an exam. May include instructions for no food or water "X" number of hours prior to the exam; taking of medications; partially or fully disrobing.

PTID - Patient identification: Name, family member prefix, sponsor's SSN, and date of birth.

Patient Processing Folder (pt. proc. folder or proc. folder) - A folder provided for each patient that includes schedule, department map, flash cards, warnings, exam request.

QC - Quality control. Each set of images is developed as soon after the exam has been completed as possible, and reviewed to insure that the quality and number of views are satisfactory.

Rad - Radiology Department.

Record Retention - Images and records are maintained for five years after the date of last activity. The images are then salvaged for their silver content.

Registration - The entering of patient data into a record system to show the patient has received, or is eligible for, care and to establish patient records for the patient.

Requestor Eligibility - The process of determining who may obtain images. In order to obtain images on loan, the requestor must have loan privileges.

Schedule Process - The process of actually locating time when a patient, care provider, and equipment are available for a procedure.

Special Procedure - A subset of specific exams usually requiring specially trained technicians. Special procedures will be done in an area on the 4th floor in the new WRAMC.

SSN - Social Security Number. Military records use the sponsor's SSN.

Subfolders - A subset of images in a Master Folder such as bone, chest, or similar grouping.

Tomo - Tomogram. A special type of radiograph obtained by appropriate movement of the X-ray tube and film or patient which permits visualization of a particular plane through the anatomic structure of interest.

Treatment Plan - The planned treatment schedule for Radiation Therapy or Nuclear Medicine agreed to by physician, radiologist, and patient.

Tracking Log - A record of the location of the patient during the time he is in the department. It contains (depending on the MTF) the patient's arrival in the department, his entrance and exit of the exam room, his exit from the department. Used to compute time in the department, actual exam times, wait times, etc.

Validation of Request - Permission by an authorized representative of Radiology that the requested exam should be performed.

View Consult - Films are maintained in the view consult room for 24 hours after the images have been made.

Wet Read - The immediate preparation of a report of an exam to be returned to the requestor by the patient who waits for it upon completion of the exam.

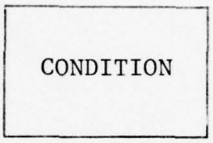
CONDITION-ACTION
DIAGRAM INTERPRETATION GUIDE

1. ACTION

When an action circle is encountered, the specified action, procedure, function, or process is to be performed as noted. An action is performed. It never has a truth (true or false) value.

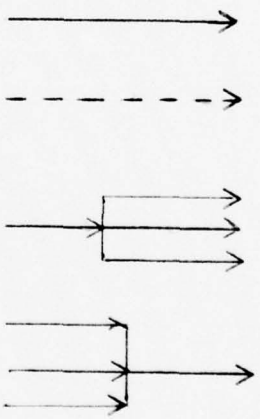
2. CONDITION

When a condition box is encountered, the specified condition is to be evaluated; and, if it holds true or succeeds, the following blocks on the diagram are to be executed. This box is also used to denote the condition which caused this path to be taken.



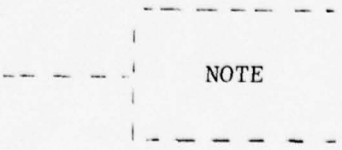
3. FLOWLINES

Flow proceeds through the diagram along the flowlines. When a flowline splits into multiple lines, all the lines must be followed (perhaps at once). If only one is intended, condition boxes will be used to select the proper line. When flowlines join or reconsolidate into a single line, that line is to be followed regardless of the number of joining lines that were active. Control, execution, or interpretation of the diagram is shown by solid flowlines. Data and information are usually assumed to accompany control; but, where necessary for clarity, it is shown by "dash" lines, regardless of media.



4. NOTE

Clarifying notes, comments, remarks, and other annotations, including references to additional documentation, are enclosed in "dash" note boxes and are connected to the annotated structure by "dash" lines.

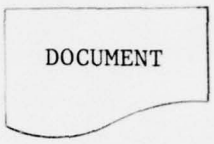


5. STORAGE

A triangular storage block indicates storage of information or data regardless of the medium of storage.

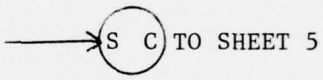
6. DOCUMENT

A document symbol represents information or data, regardless of media. (It may or may not physically reside on a a document). It is used only for clarity, as information such as that contained in the "document" is assumed to be always present along with the control flow.



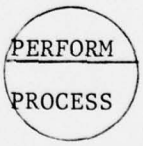
7. CONNECTOR

A connector circle specifies that the flow continues on another page or section of this page. An out-connector contains a number (which is the sheet number at which the flow is continued) and a letter (which specifies which in-connector on that sheet is being referenced). The in connector contains the matching number/ letter code. Adjacent to the connectors is a notation as to the sheet and process to which the connectors refer.



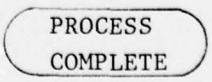
8. PROCESS

The process symbol at right indicates a process to be performed. The process referenced will be diagrammed in its own set of condition-action flowcharts which are included in the same packet of flowcharts for reference. After the process is performed, flow resumes.



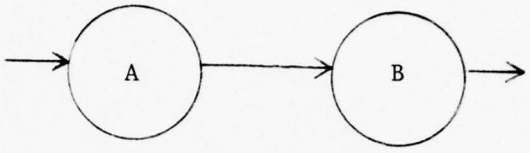
9. TERMINATOR

The oblong terminator symbol indicates that the current process or sub-process is complete. Normally, upon completion of a process, control returns to the process which invoked it and resumes where it left off in that process.

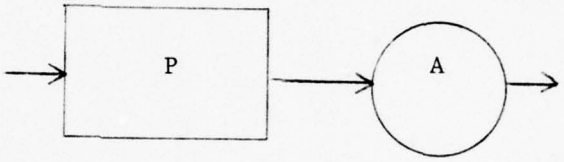


CONDITION-ACTION
EXAMPLES

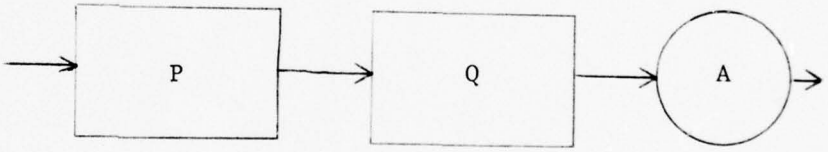
Perform Action A first,
then in sequence,
perform B.



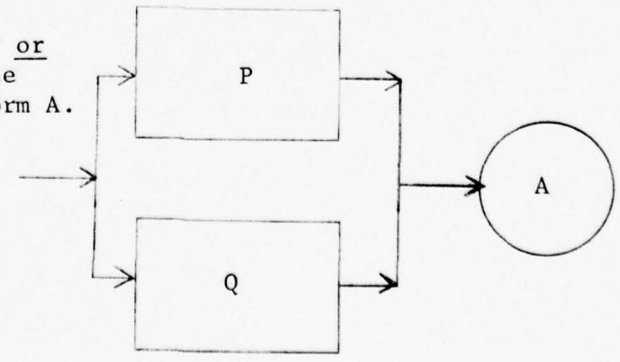
If Condition P holds true,
then perform Action A.



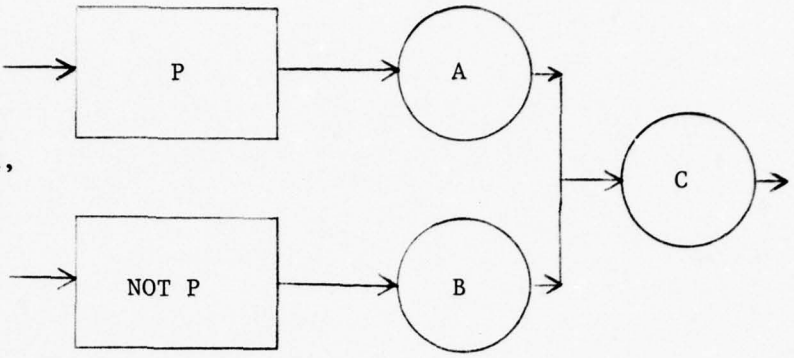
If both Condition P and
Condition Q hold true,
then perform A.



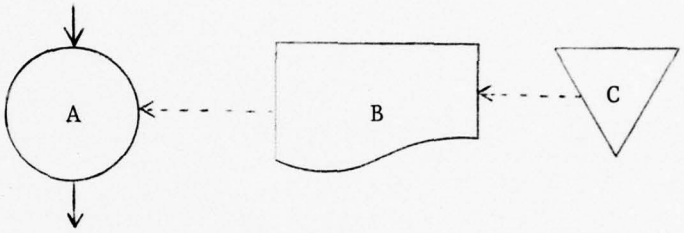
If either Condition P or
Condition Q holds true
(or both), then perform A.



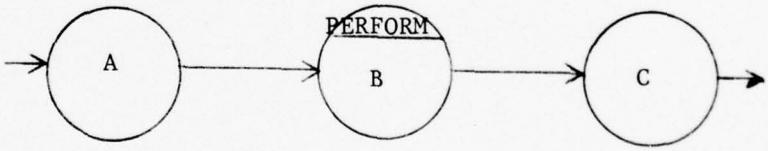
If Condition P holds true, then perform Action A, but not B. If P does not hold, then perform B, but not A. In any case, when done, perform C.

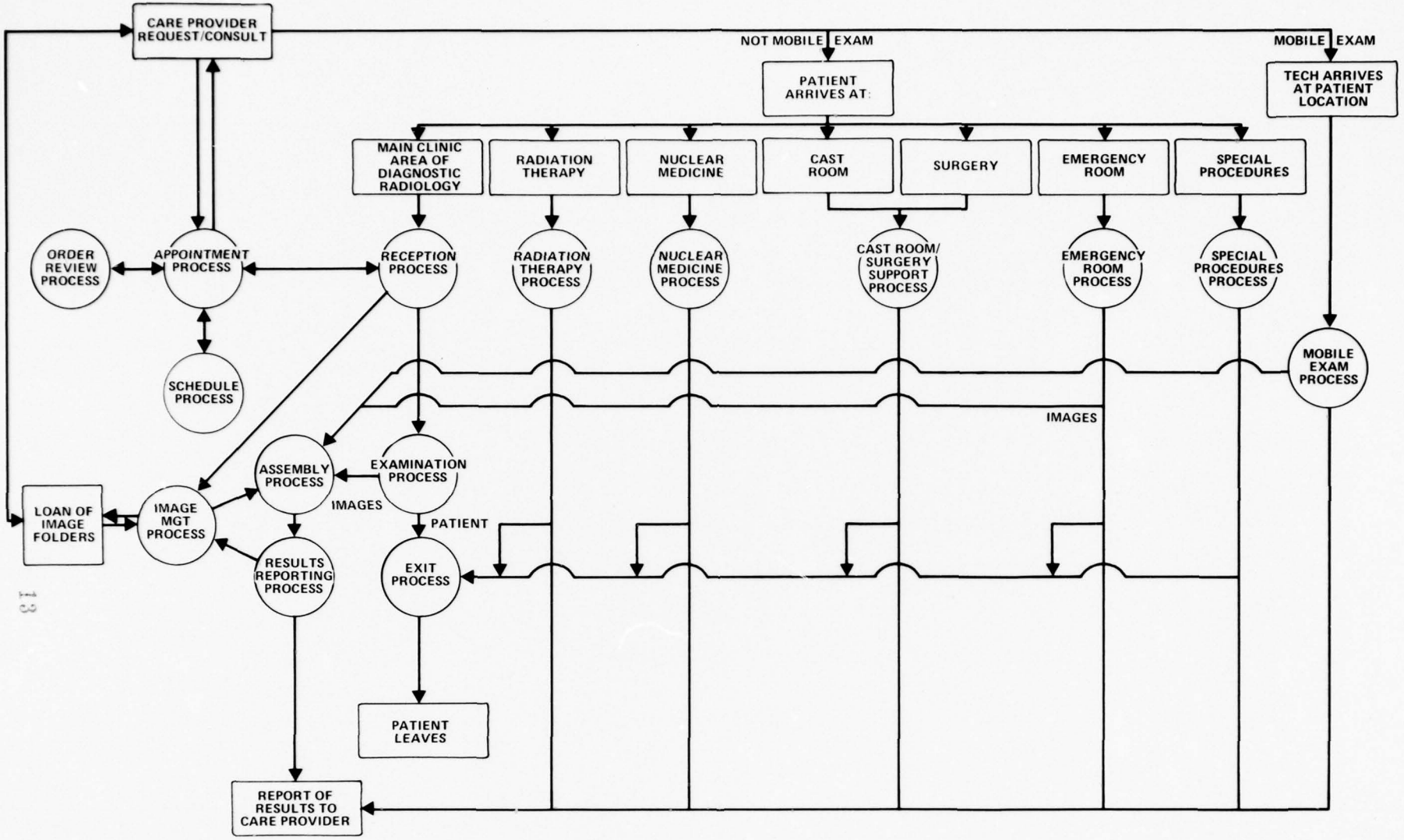


Perform Action A, utilizing information contained on the document B which was retrieved from the File C.



First perform Action A. Then perform Process B, which is itself flow-charted elsewhere in this set of charts. After B is completed, return to here and perform Action C.





RADIOLOGY SUBSYSTEM
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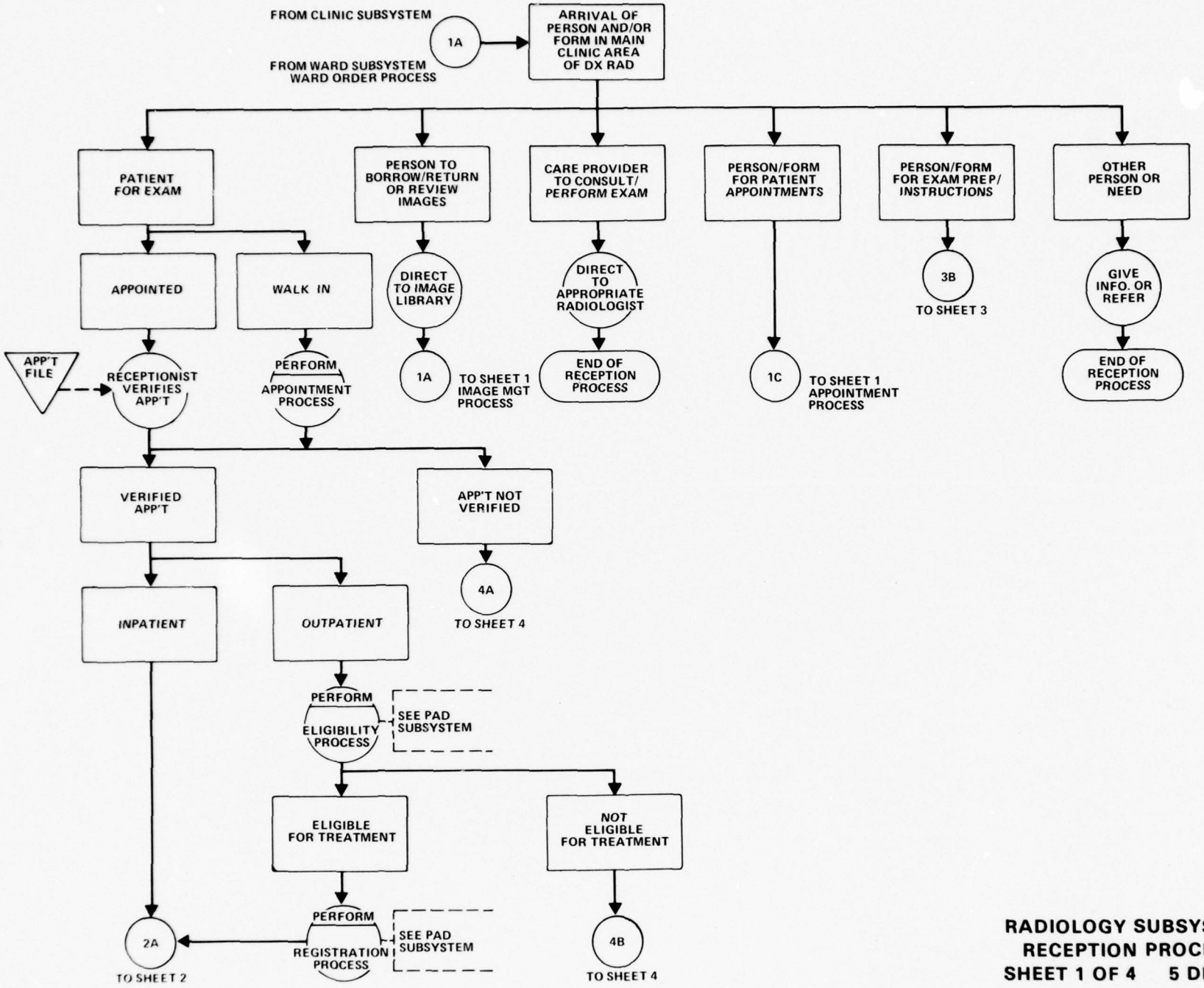

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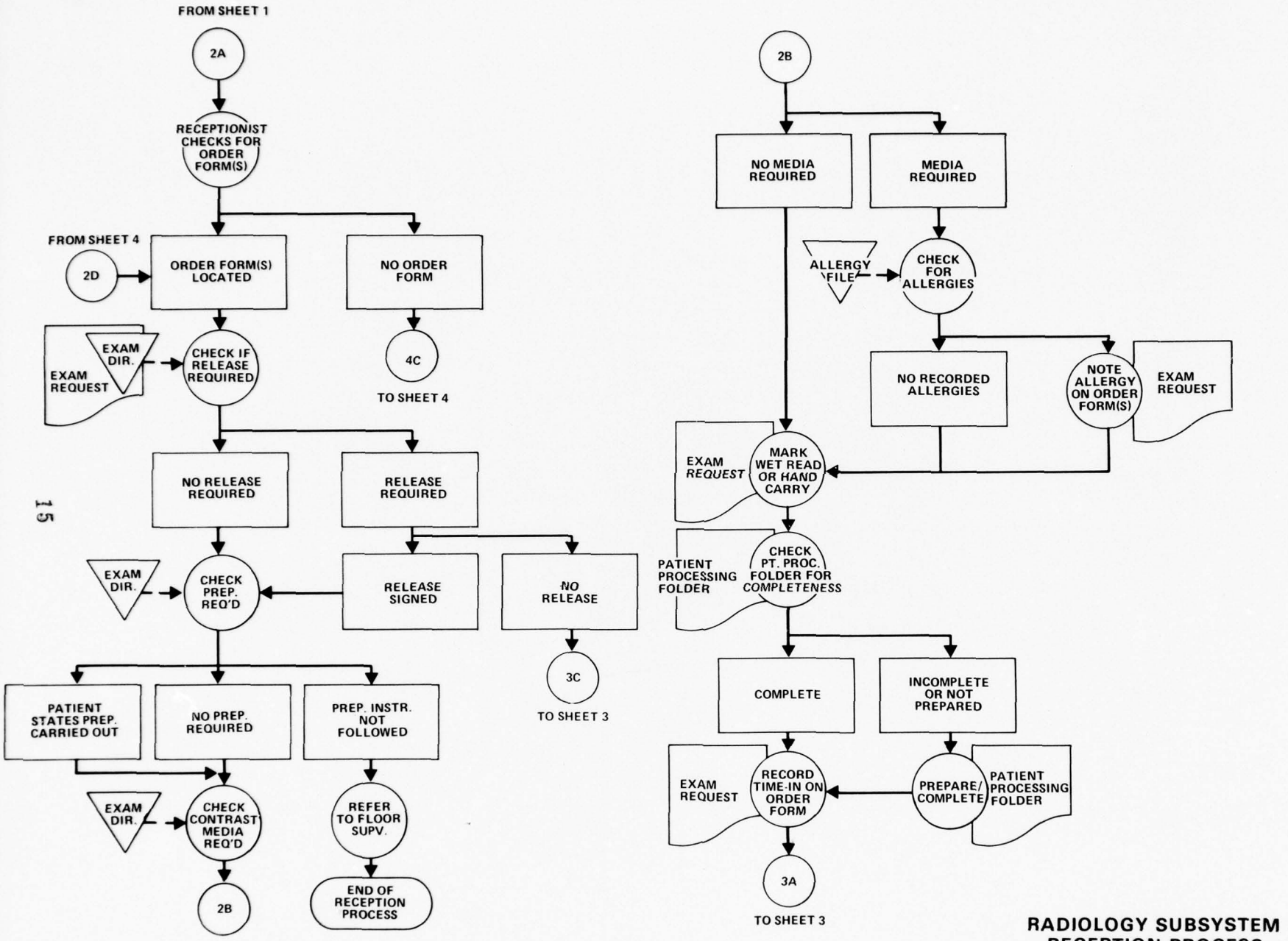
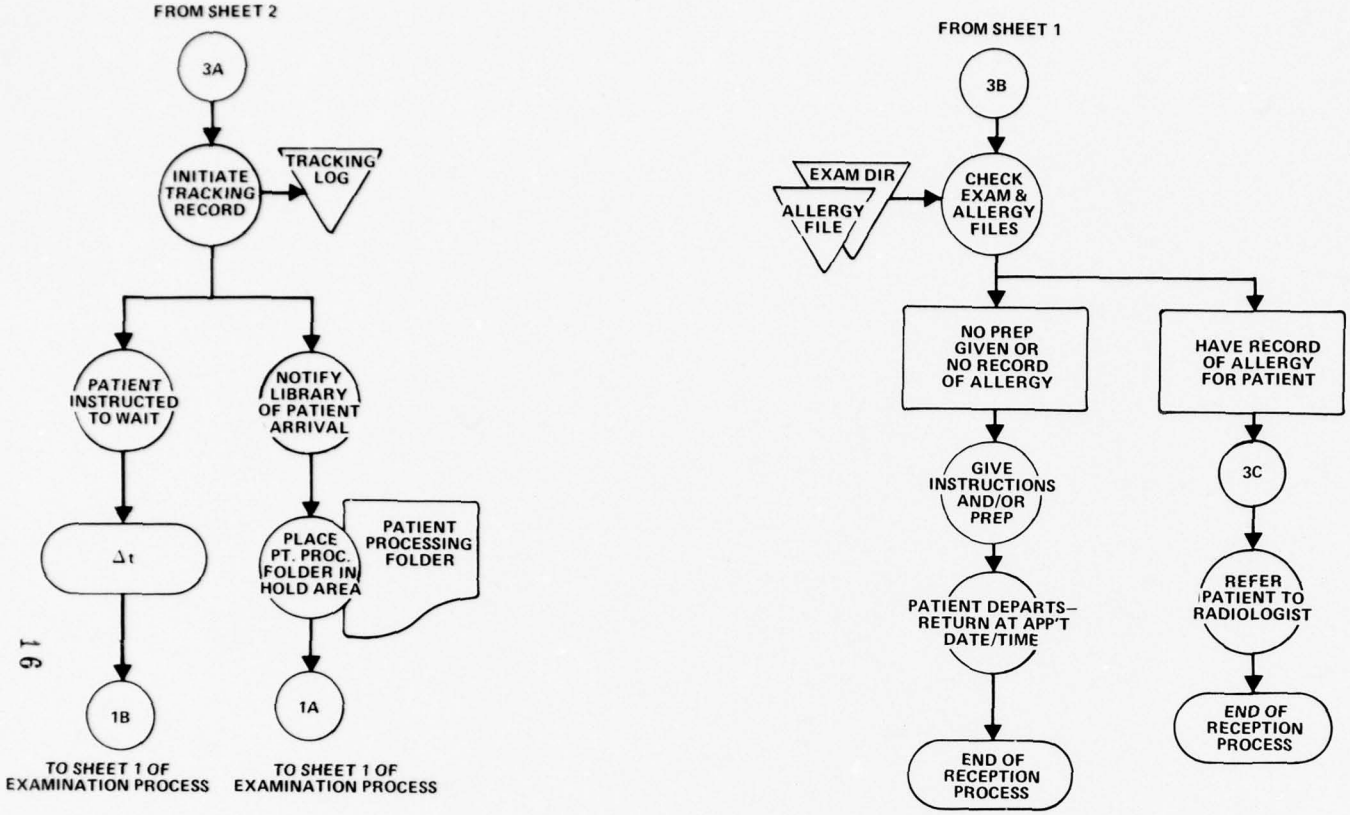
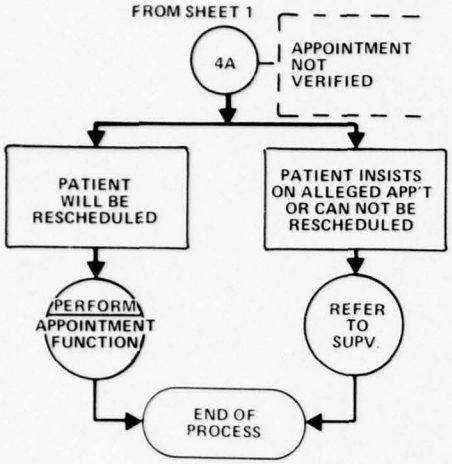
SHEET 1 OF 4 5 DEC 75

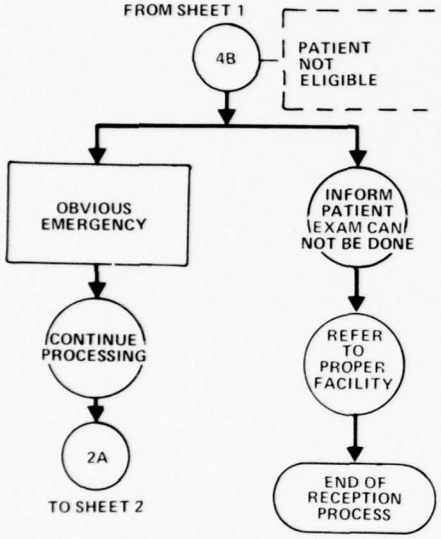


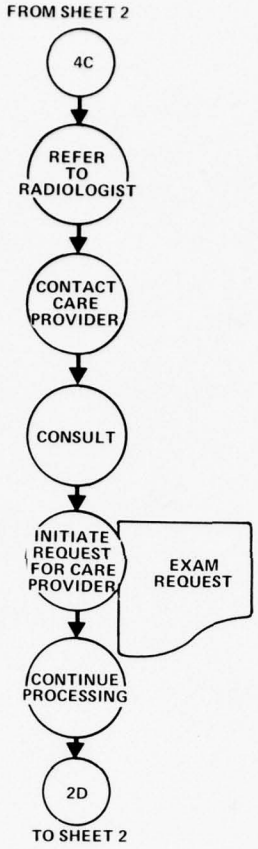
RADIOLOGY SUBSYSTEM
RECEPTION PROCESS
SHEET 2 OF 4 5 DEC 75



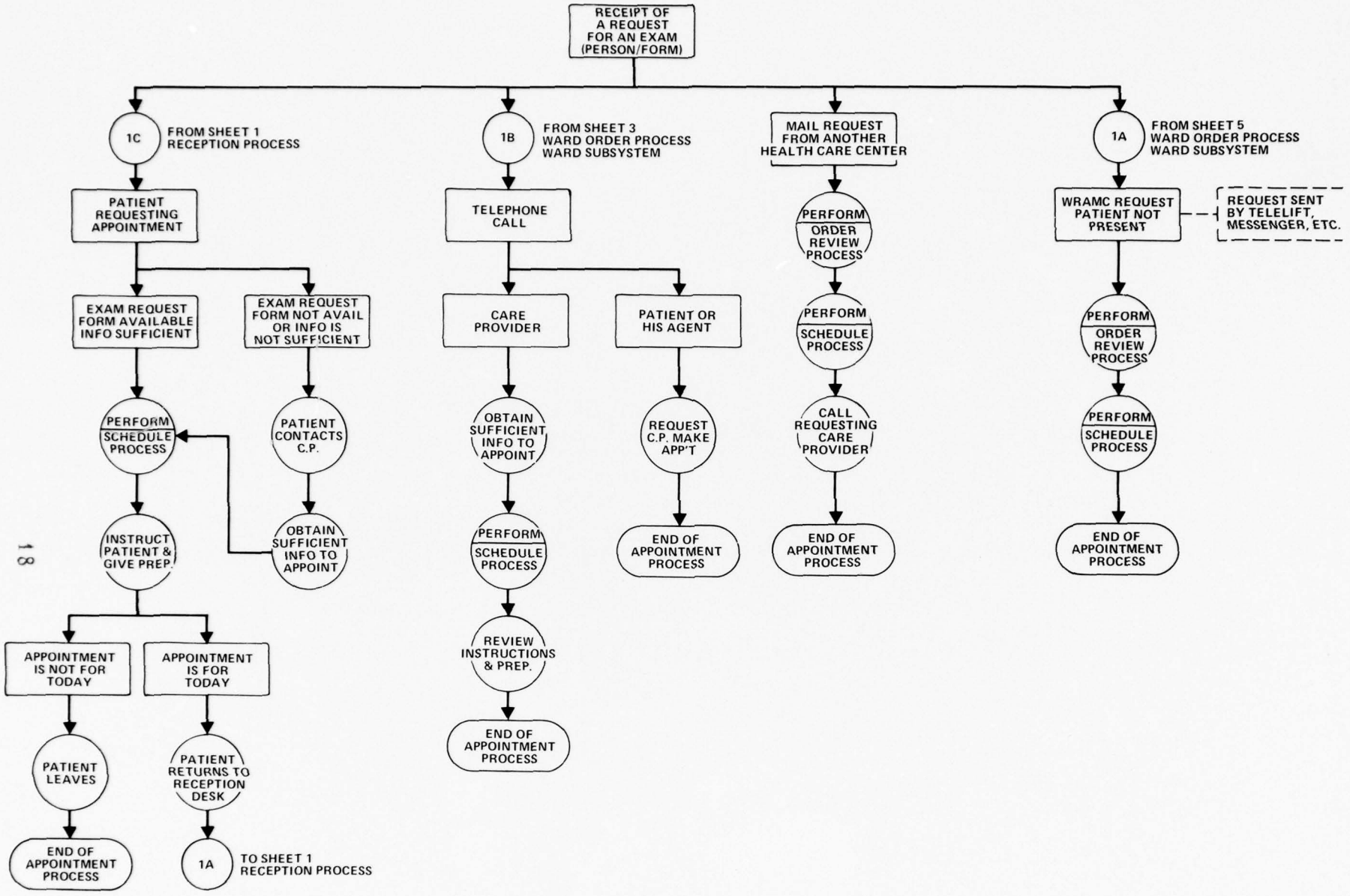
RADIOLOGY SUBSYSTEM
RECEPTION PROCESS
SHEET 3 OF 4 5 DEC 75.



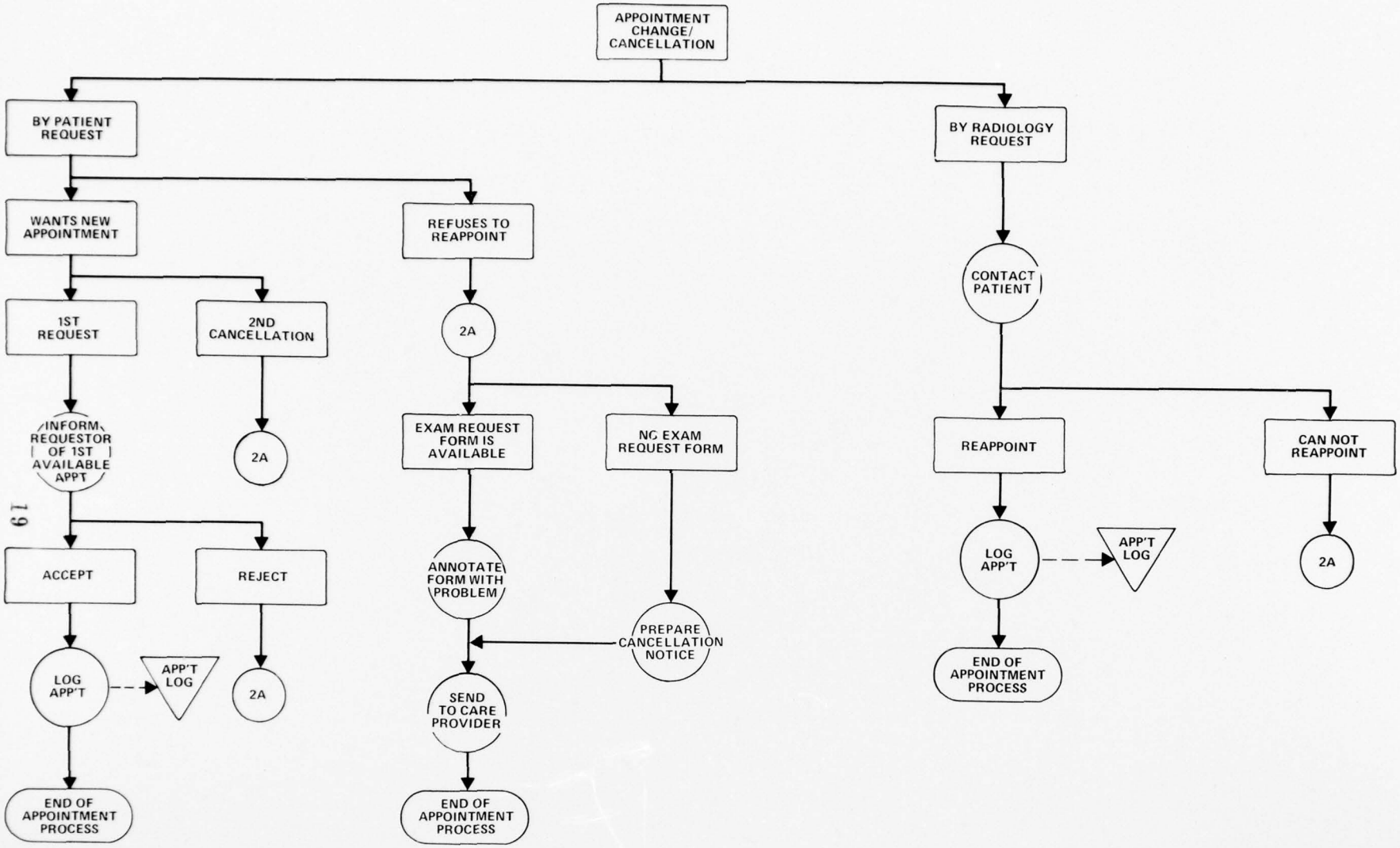




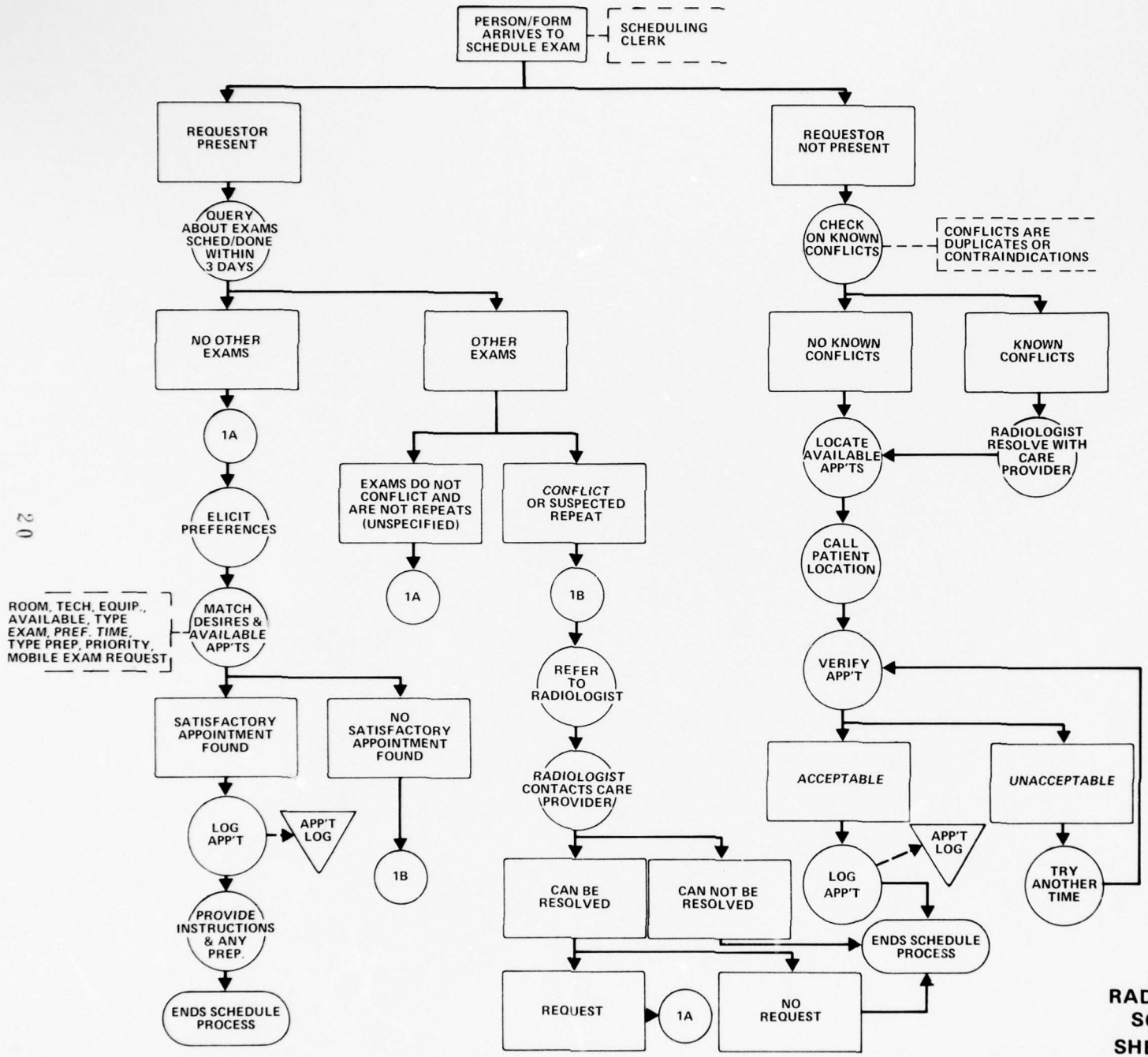
RADIOLOGY SUBSYSTEM
RECEPTION PROCESS
SHEET 4 OF 4 5 DEC 75



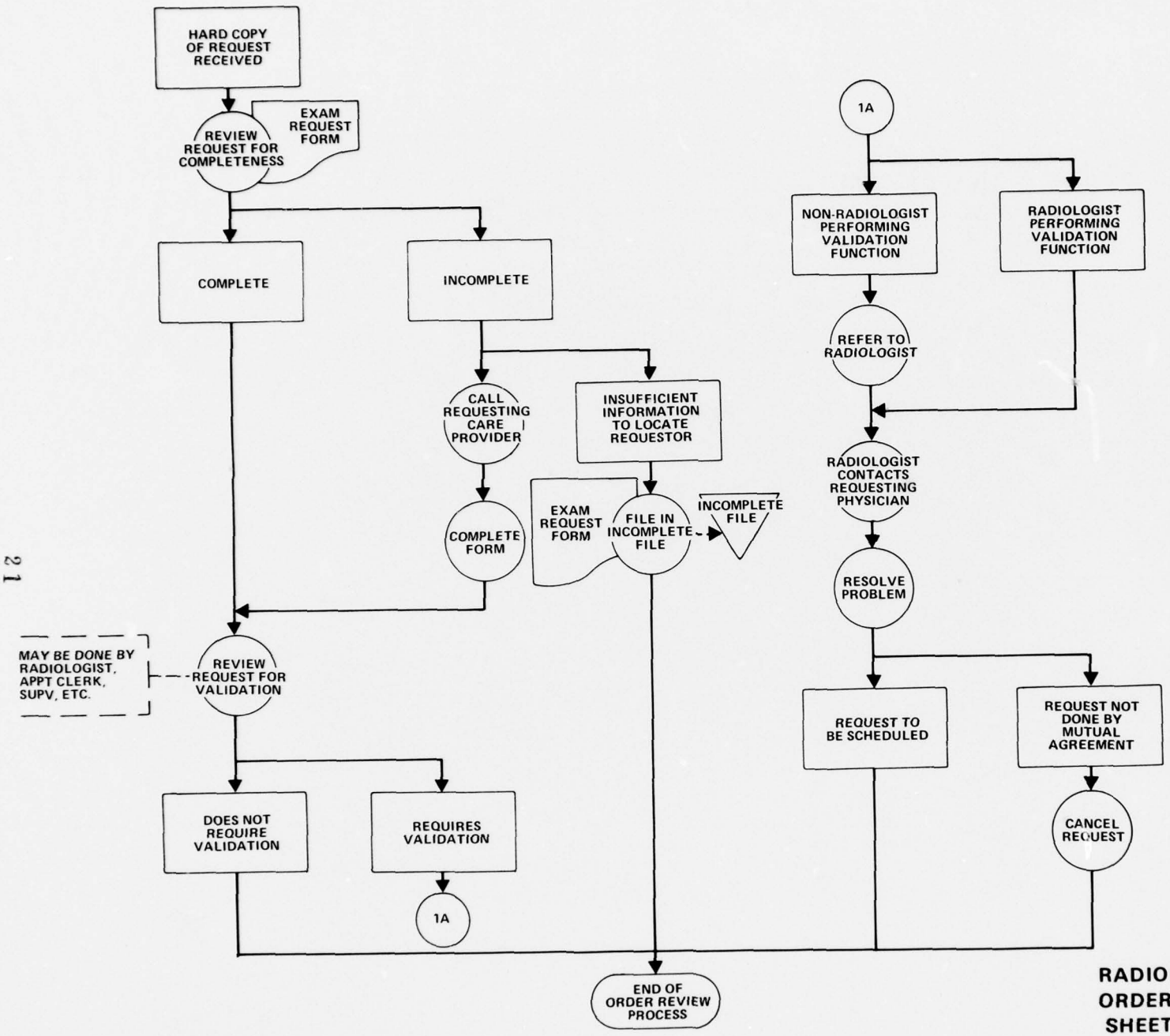
RADIOLOGY SUBSYSTEM
APPOINTMENT PROCESS
SHEET 1 OF 2 5 DEC 75



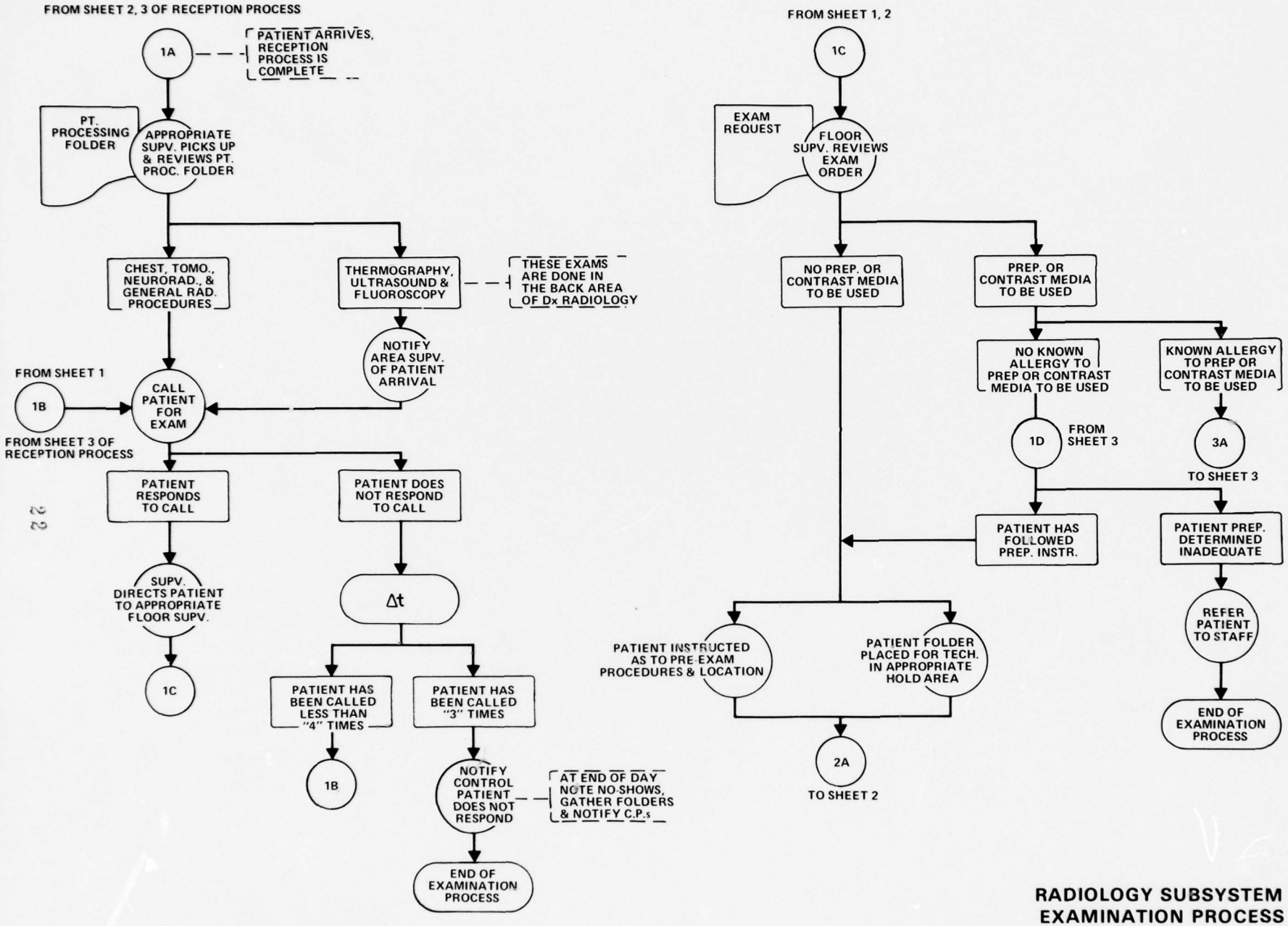
RADIOLOGY SUBSYSTEM
APPOINTMENT PROCESS
SHEET 2 OF 2 5 DEC 75



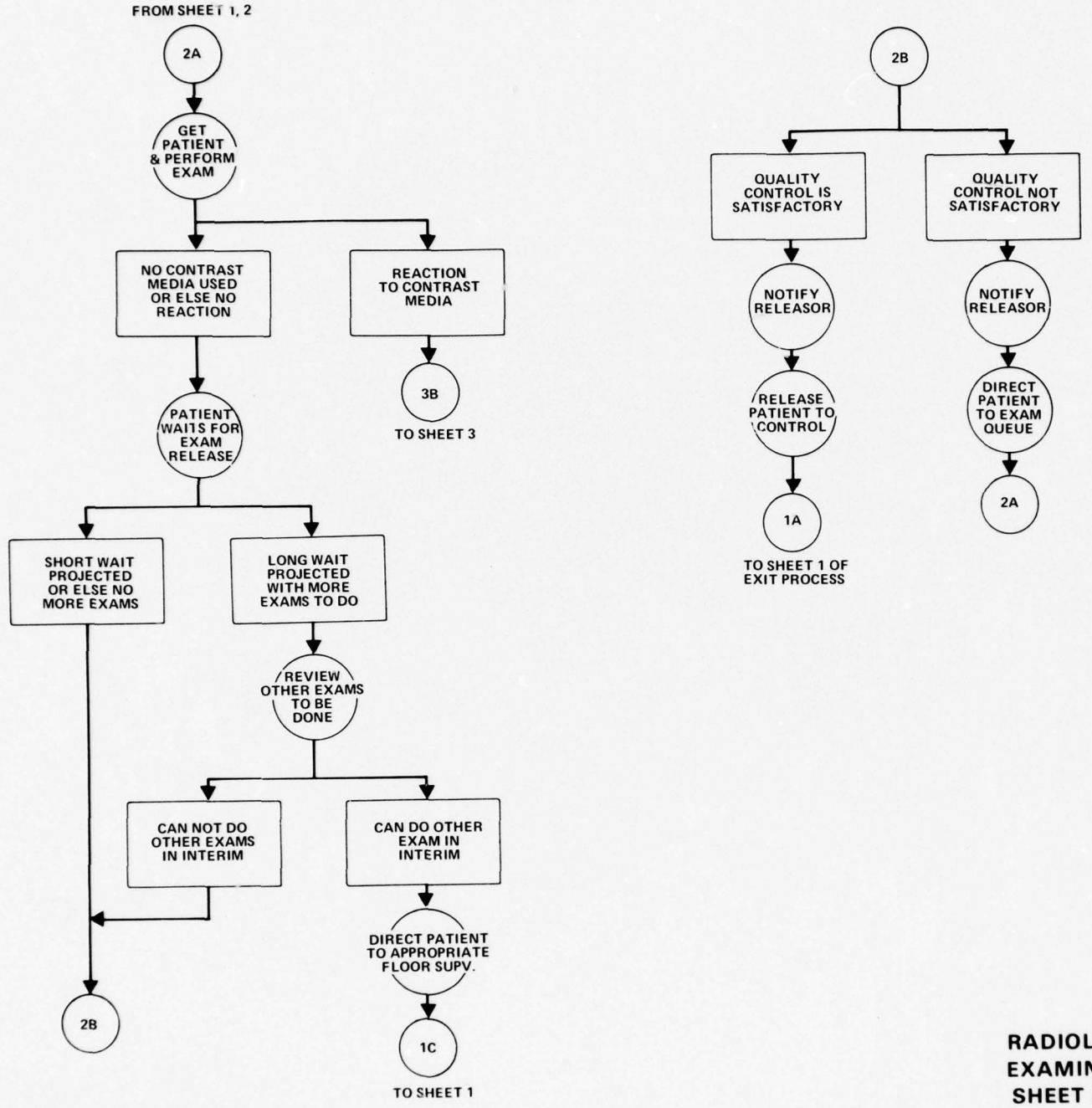
RADIOLOGY SUBSYSTEM
SCHEDULE PROCESS
SHEET 1 OF 1 5 DEC 75



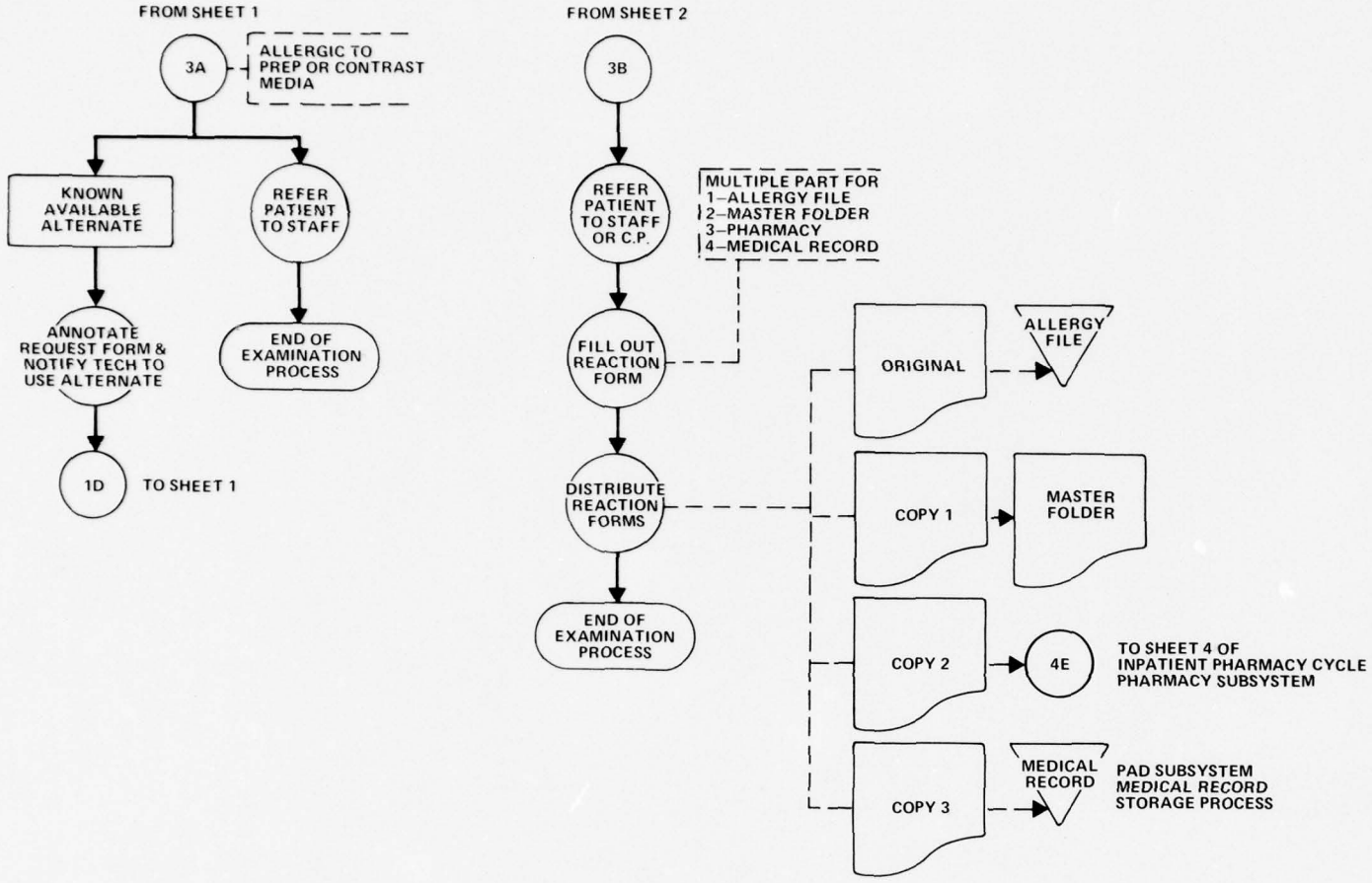
RADIOLOGY SUBSYSTEM
ORDER REVIEW PROCESS
SHEET 1 OF 1 5 DEC 75



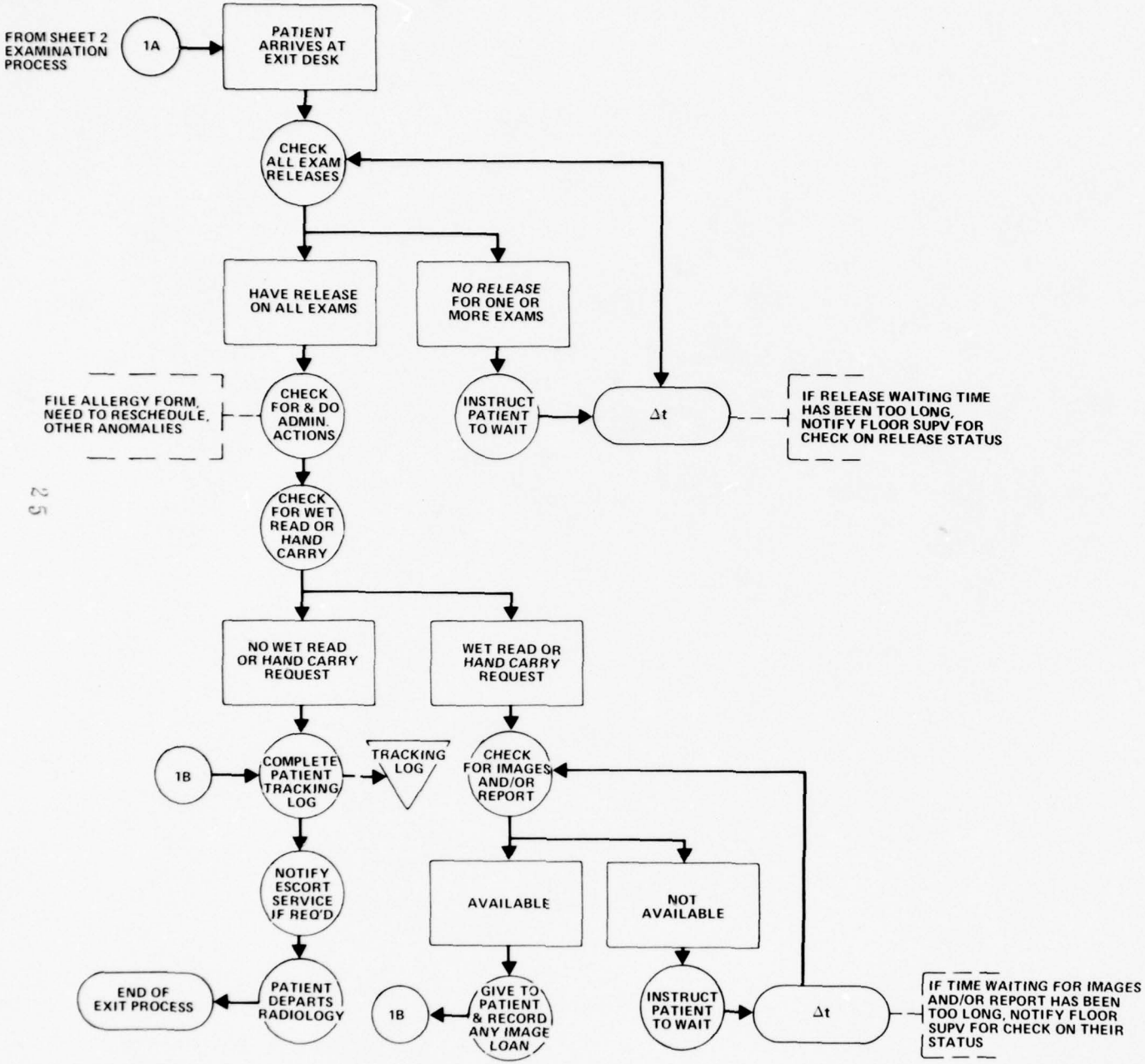
RADIOLOGY SUBSYSTEM
EXAMINATION PROCESS
SHEET 1 OF 3 5 DEC 75



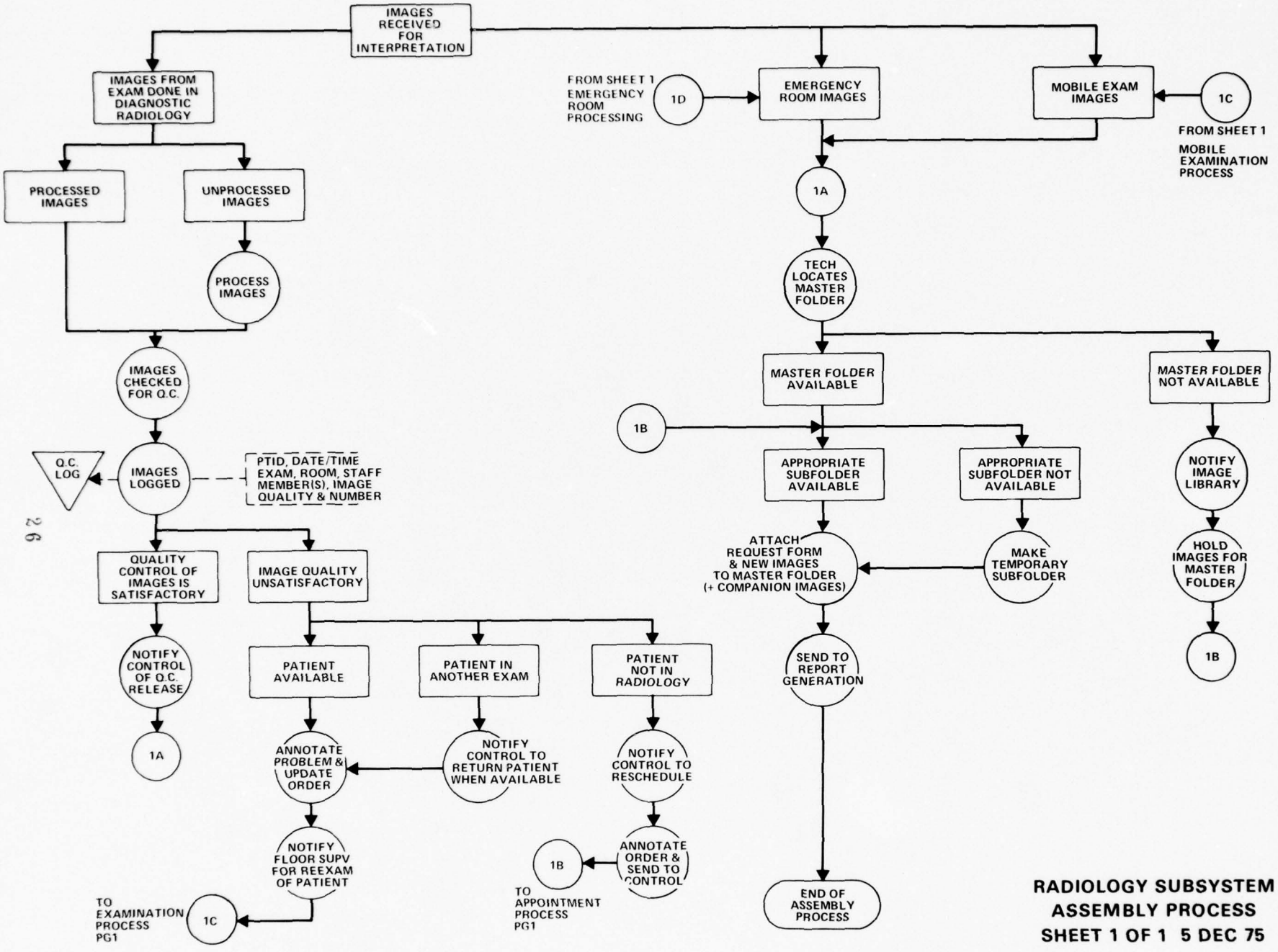
RADIOLOGY SUBSYSTEM
EXAMINATION PROCESS
SHEET 2 OF 3 5 DEC 75



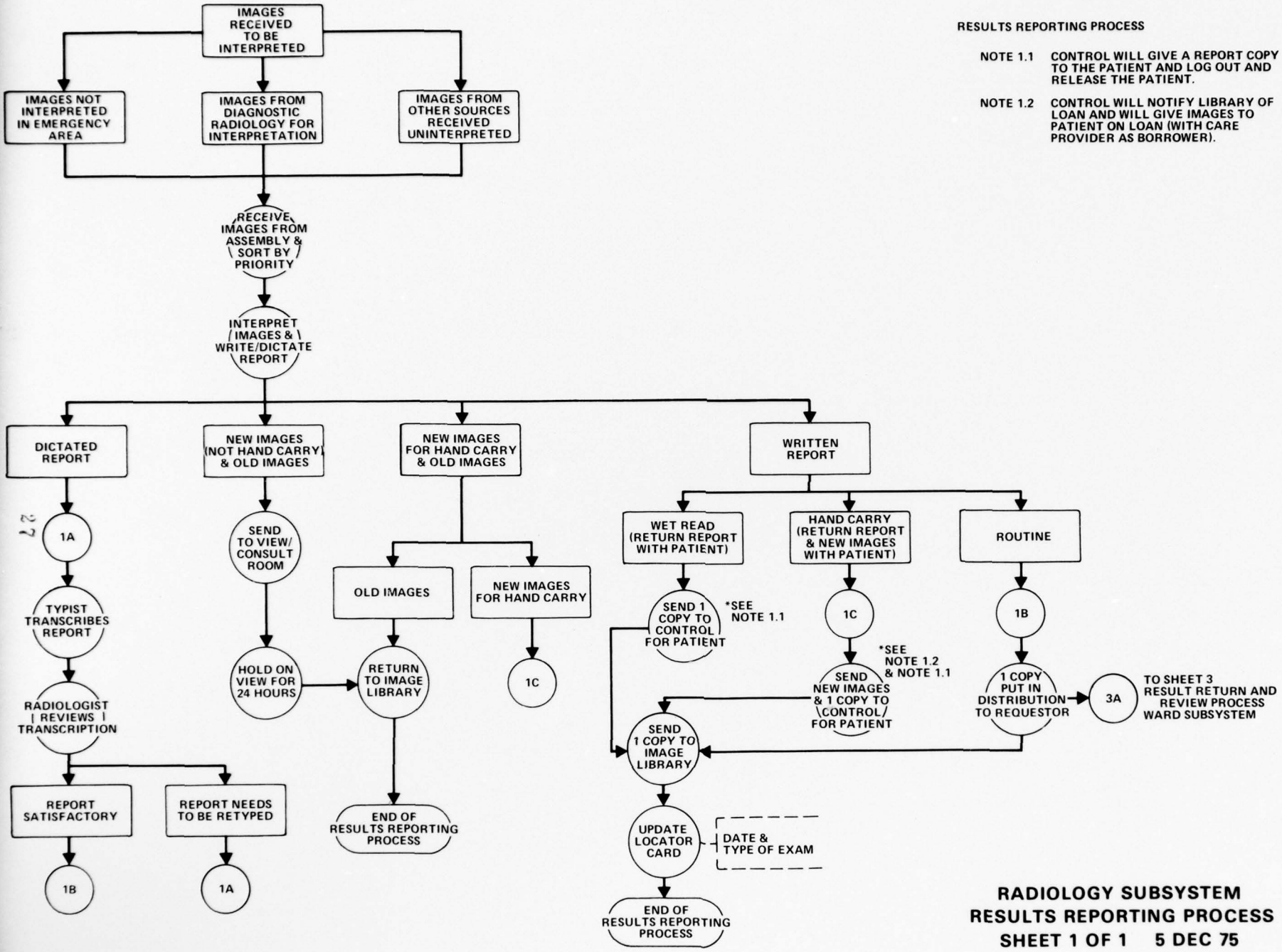
RADIOLOGY SUBSYSTEM
EXAMINATION PROCESS
SHEET 3 OF 3 5 DEC 75



RADIOLOGY SUBSYSTEM
EXIT PROCESS
SHEET 1 OF 1 5 DEC 75



RADIOLOGY SUBSYSTEM ASSEMBLY PROCESS
SHEET 1 OF 1 5 DEC 75

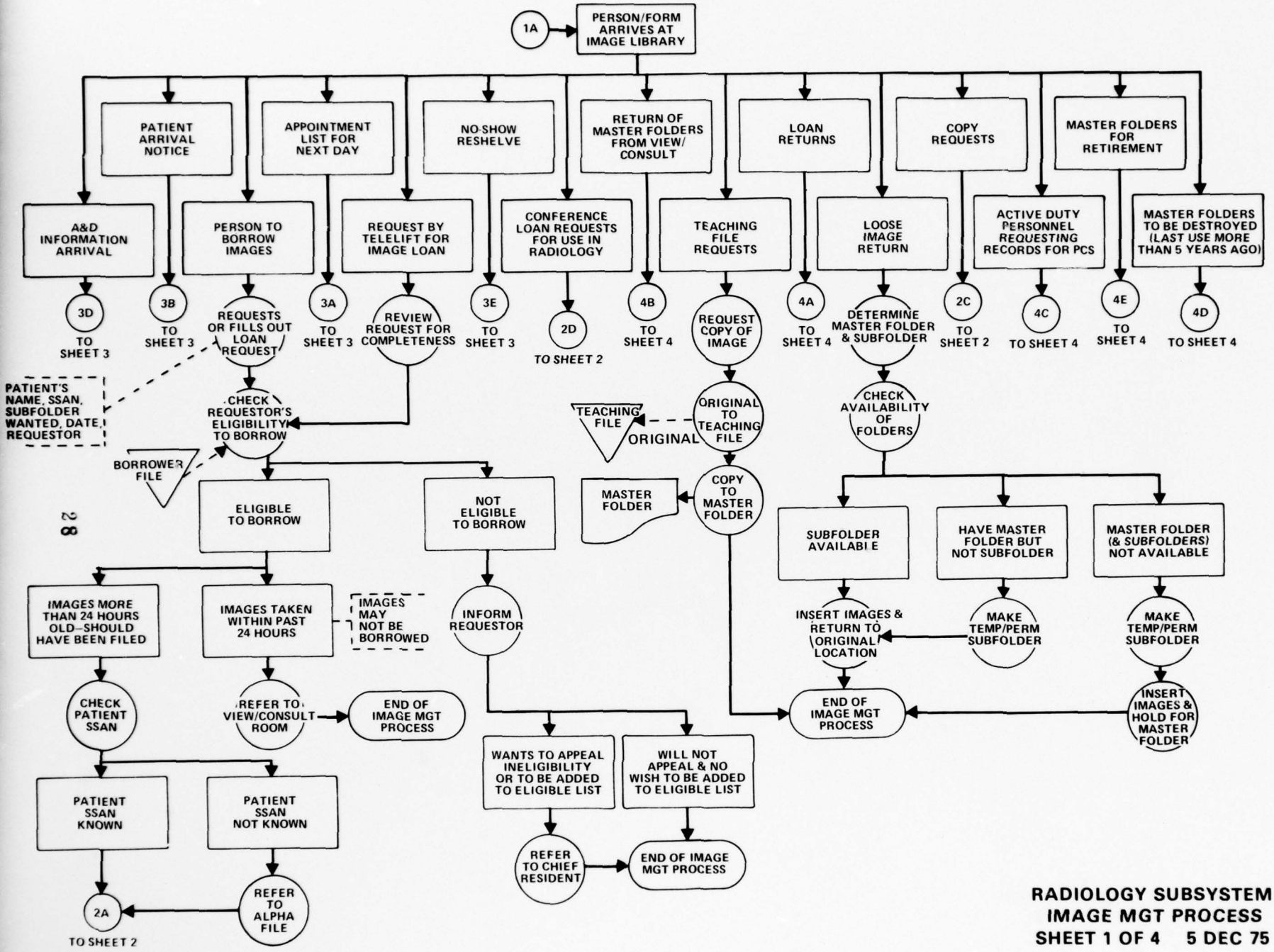


RESULTS REPORTING PROCESS

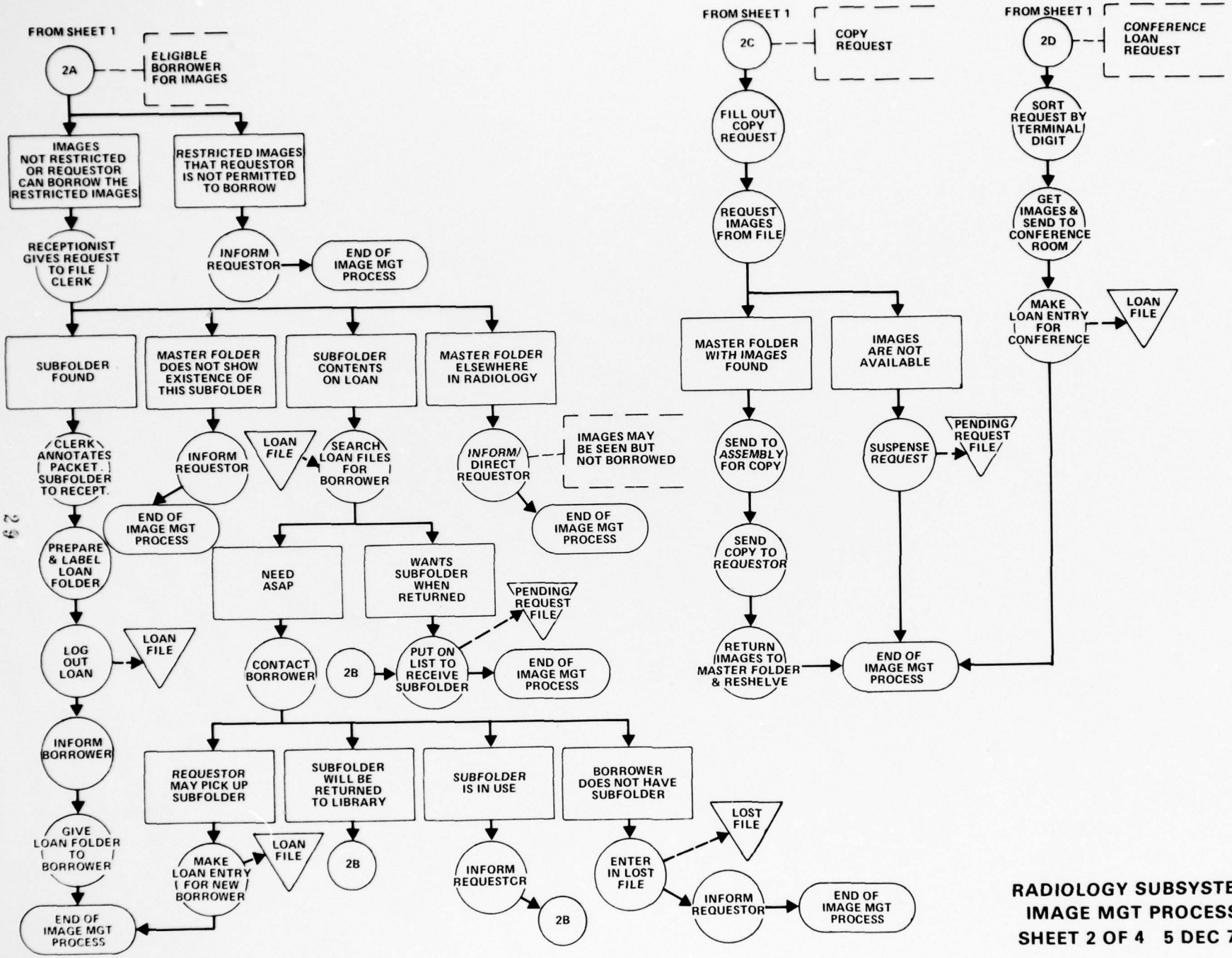
NOTE 1.1 CONTROL WILL GIVE A REPORT COPY TO THE PATIENT AND LOG OUT AND RELEASE THE PATIENT.

NOTE 1.2 CONTROL WILL NOTIFY LIBRARY OF LOAN AND WILL GIVE IMAGES TO PATIENT ON LOAN (WITH CARE PROVIDER AS BORROWER).

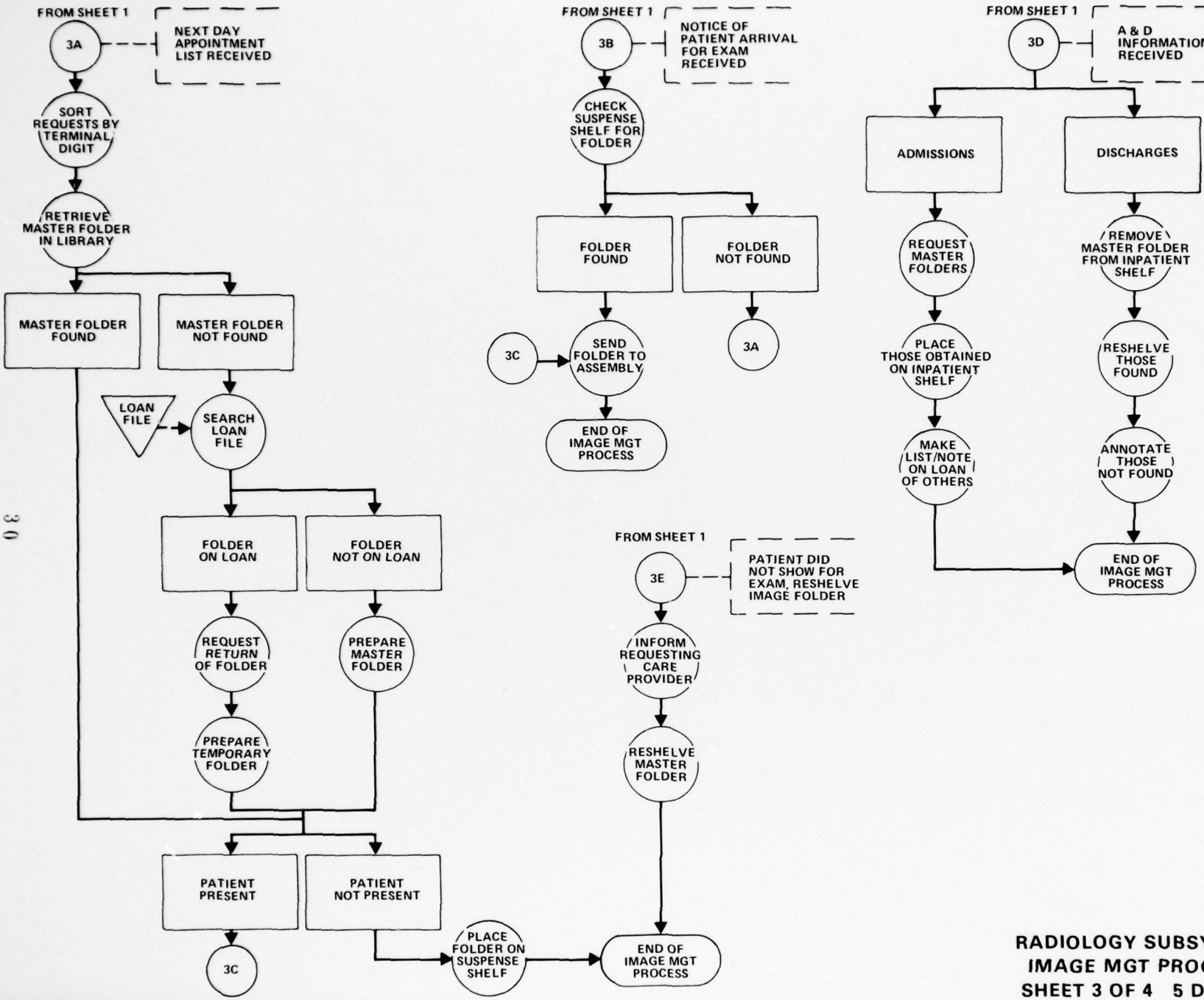
RADIOLOGY SUBSYSTEM
RESULTS REPORTING PROCESS
SHEET 1 OF 1 5 DEC 75



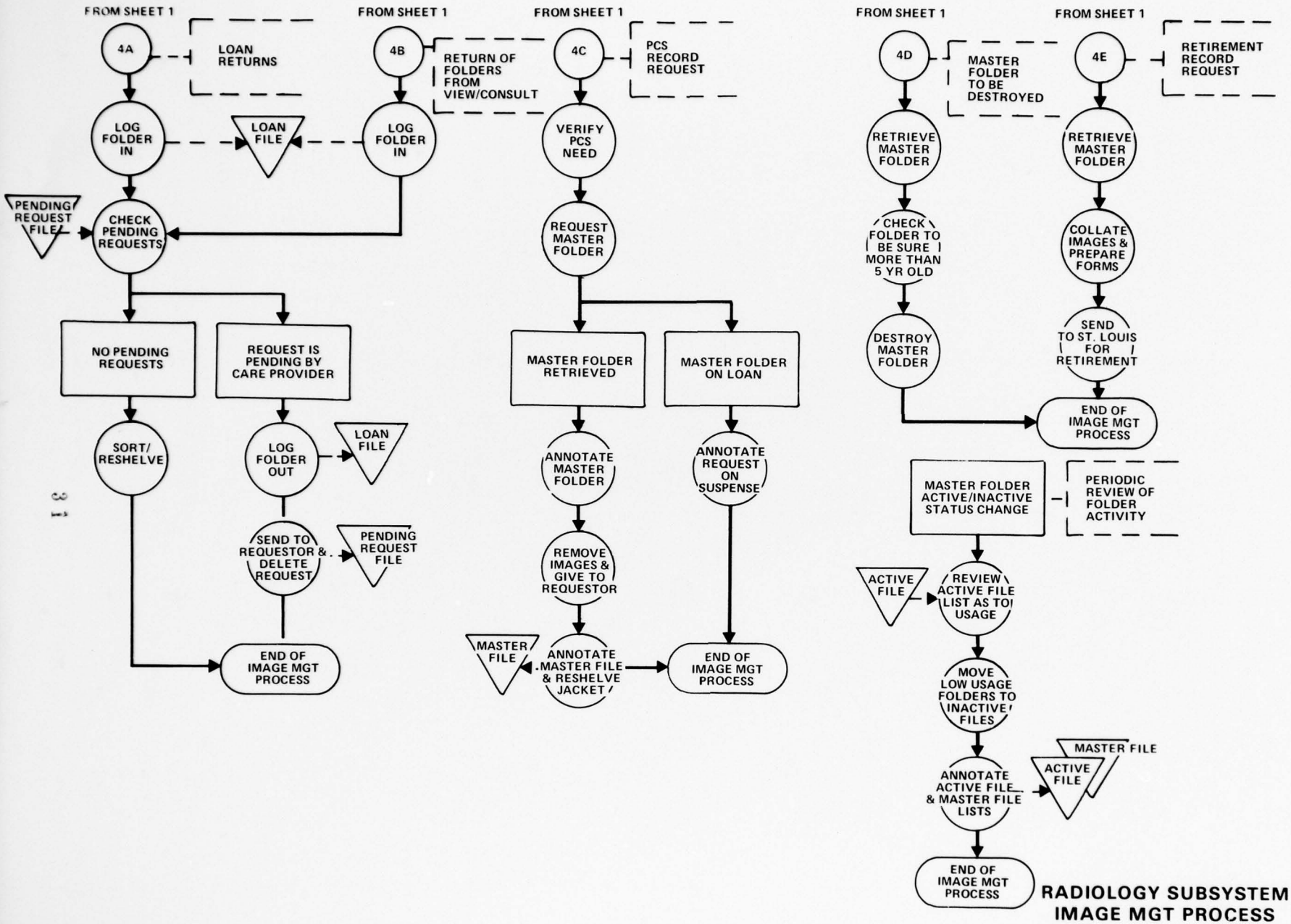
RADIOLOGY SUBSYSTEM
IMAGE MGT PROCESS
SHEET 1 OF 4 5 DEC 75



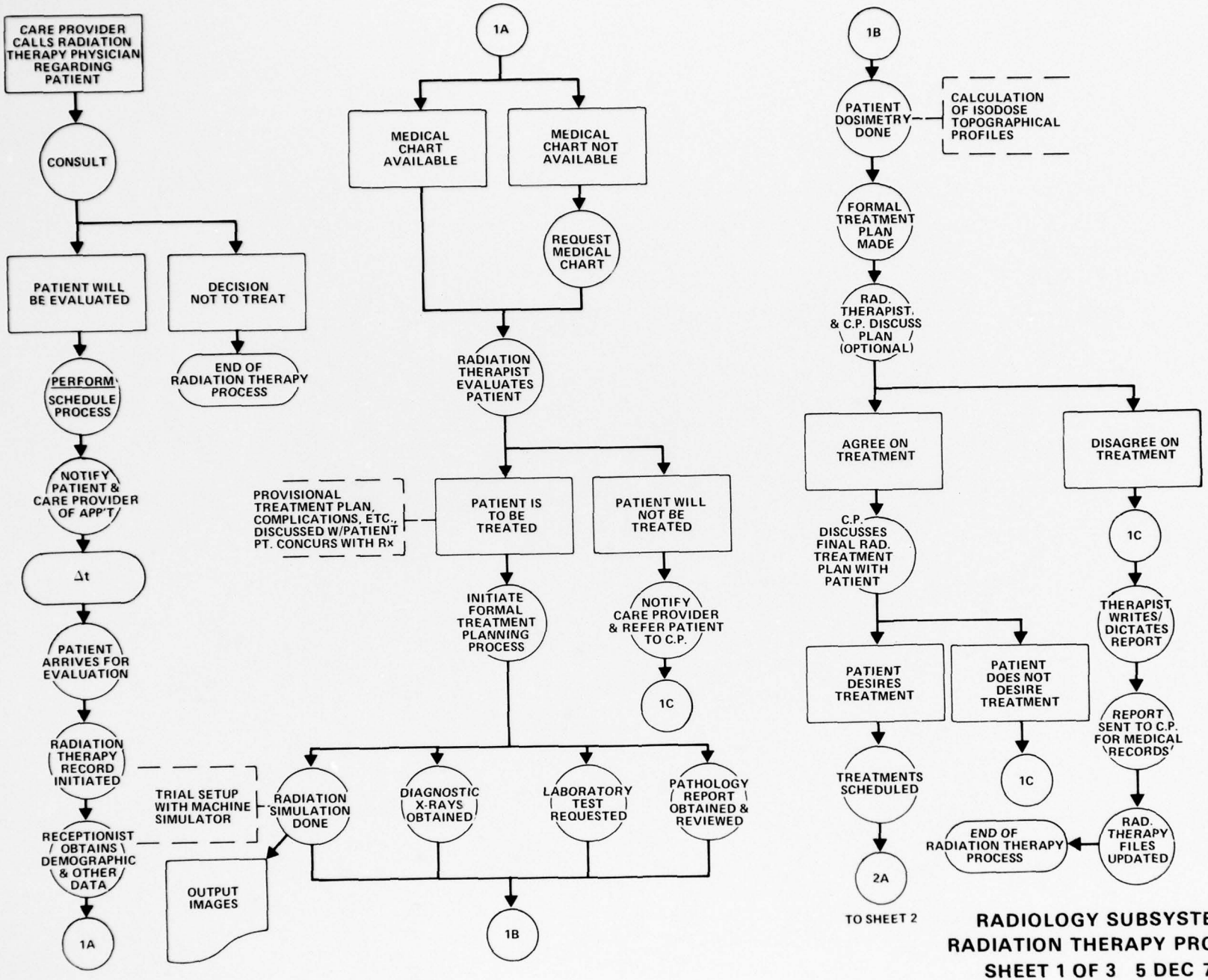
RADIOLOGY SUBSYSTEM
IMAGE MGT PROCESS
SHEET 2 OF 4 5 DEC 75



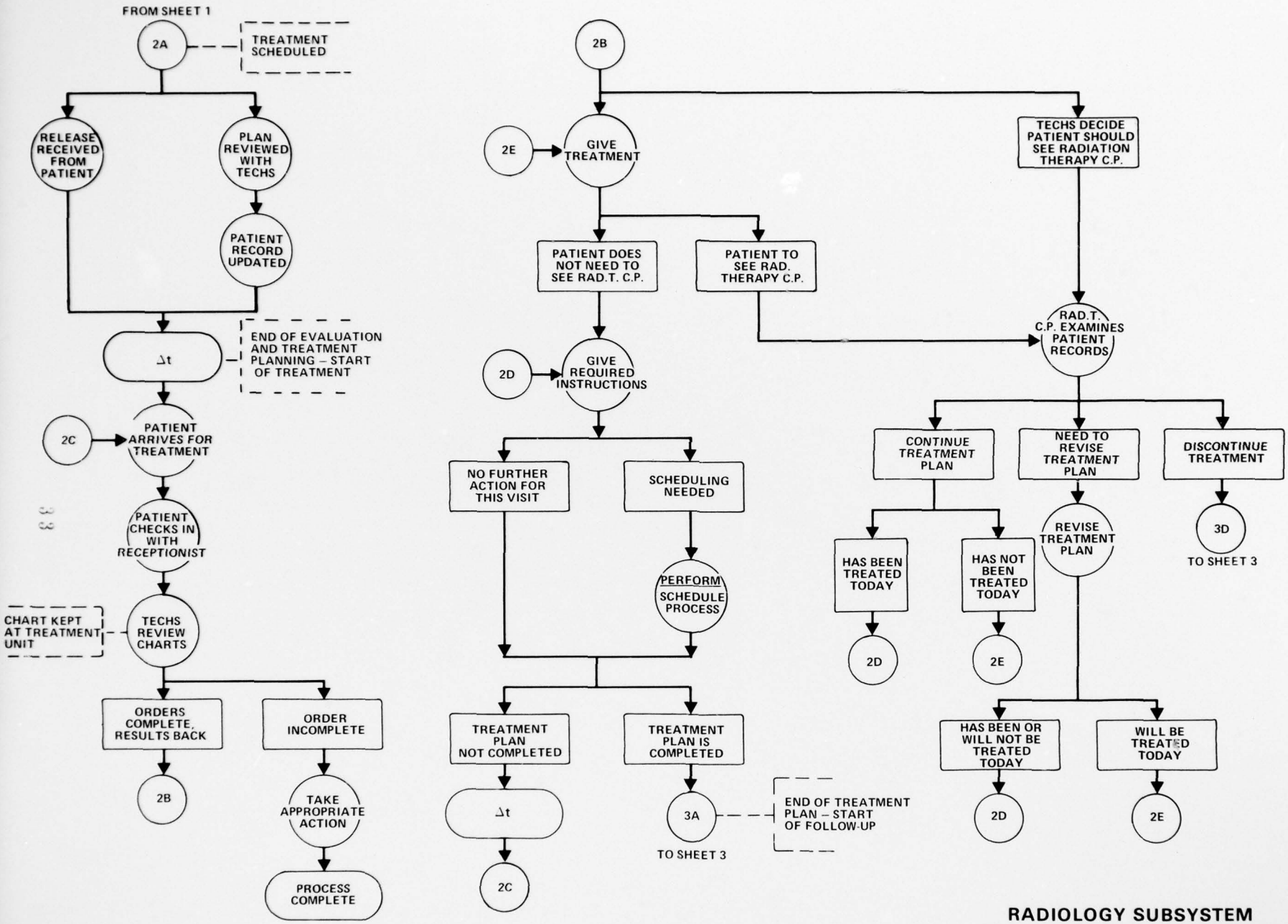
RADIOLOGY SUBSYSTEM
IMAGE MGT PROCESS
SHEET 3 OF 4 5 DEC 75



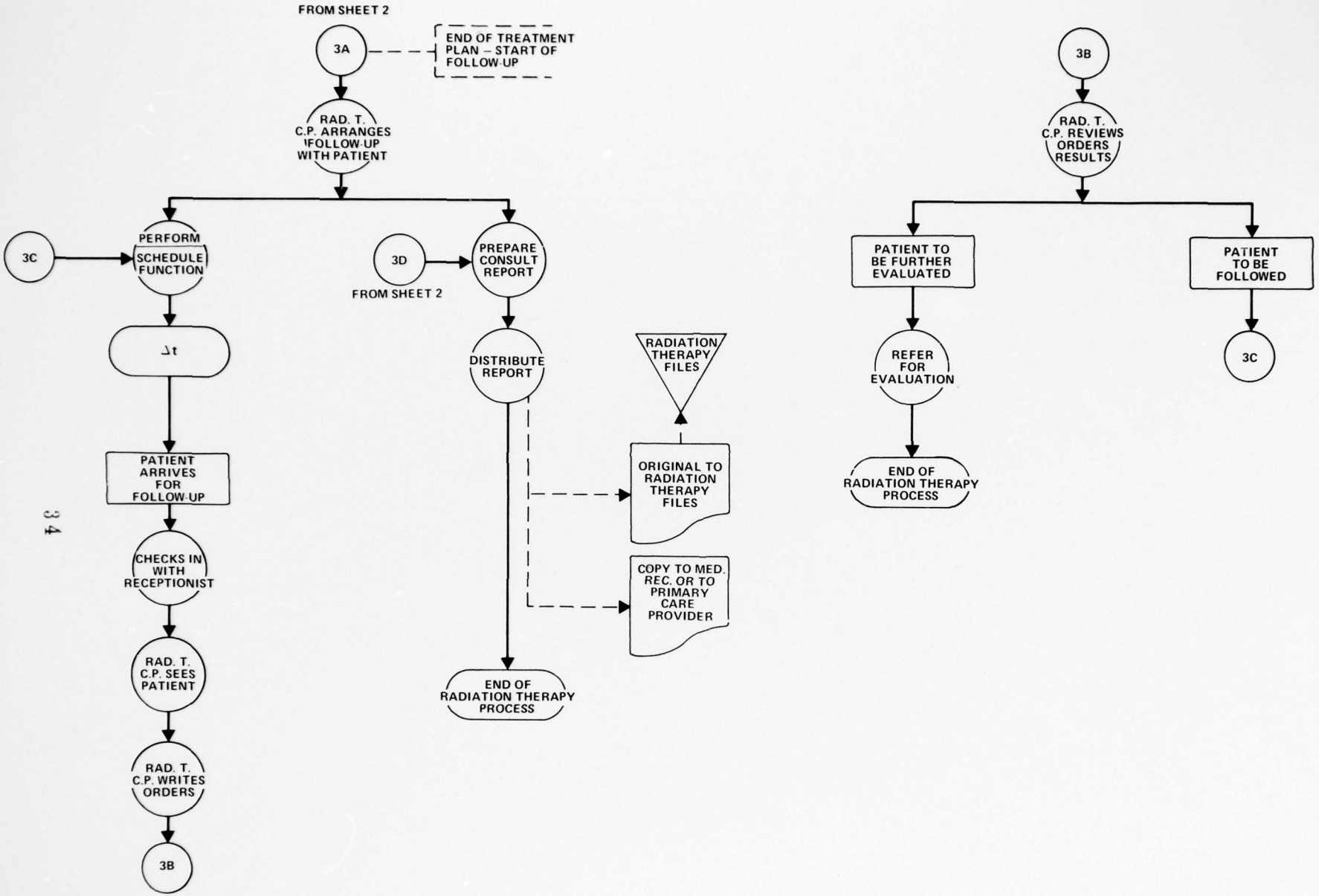
RADIOLOGY SUBSYSTEM
IMAGE MGT PROCESS
SHEET 4 OF 4 5 DEC 75



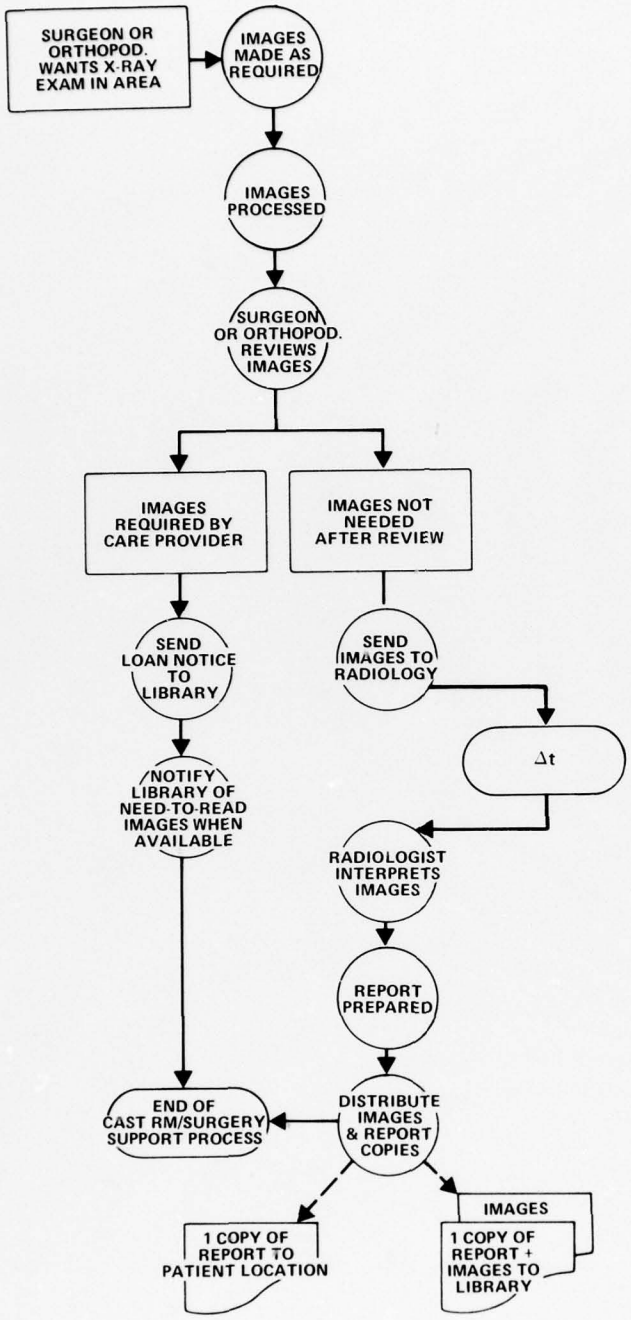
RADIOLOGY SUBSYSTEM
RADIATION THERAPY PROCESS
SHEET 1 OF 3 5 DEC 75



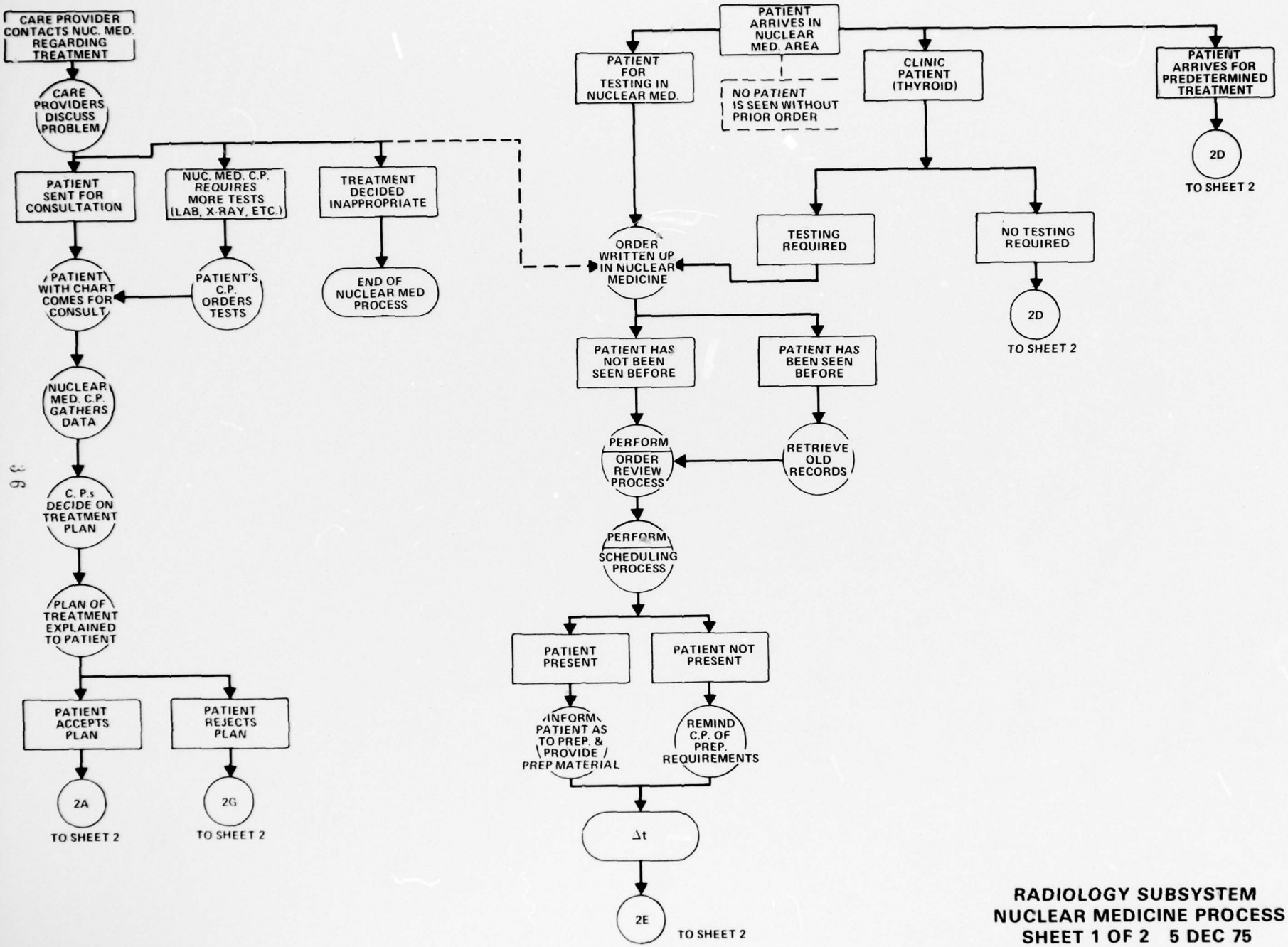
RADIOLOGY SUBSYSTEM
RADIATION THERAPY PROCESS
SHEET 2 OF 3 5 DEC 75



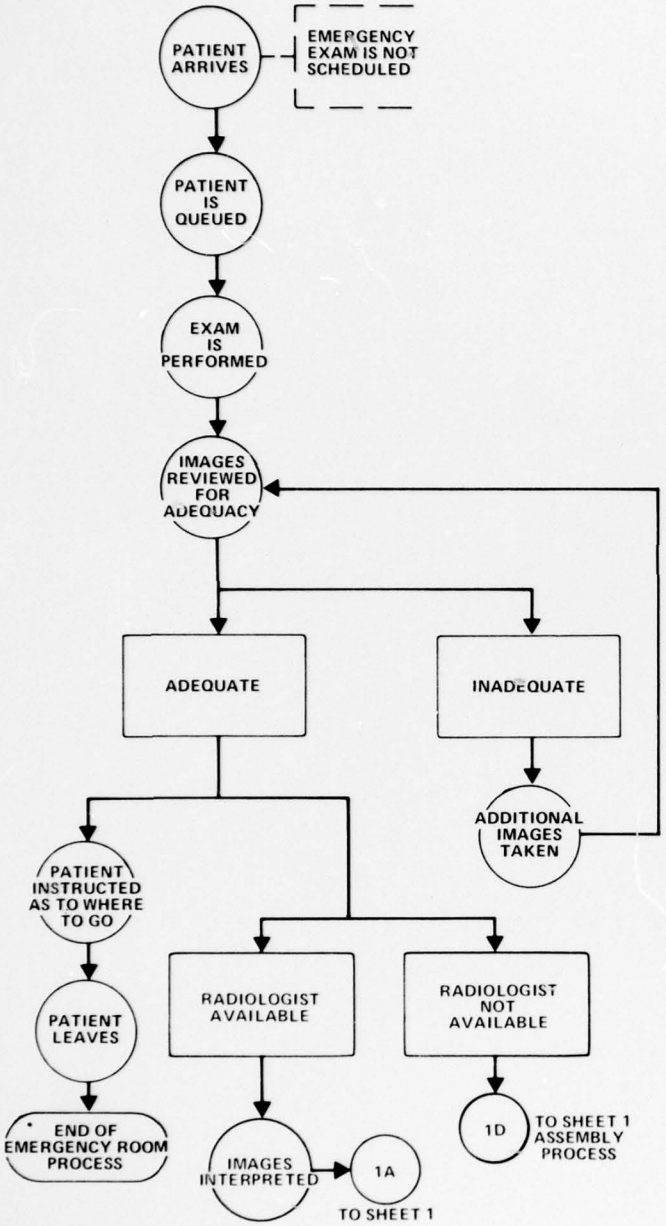
RADIOLOGY SUBSYSTEM
RADIATION THERAPY PROCESS
SHEET 3 OF 3 5 DEC 75

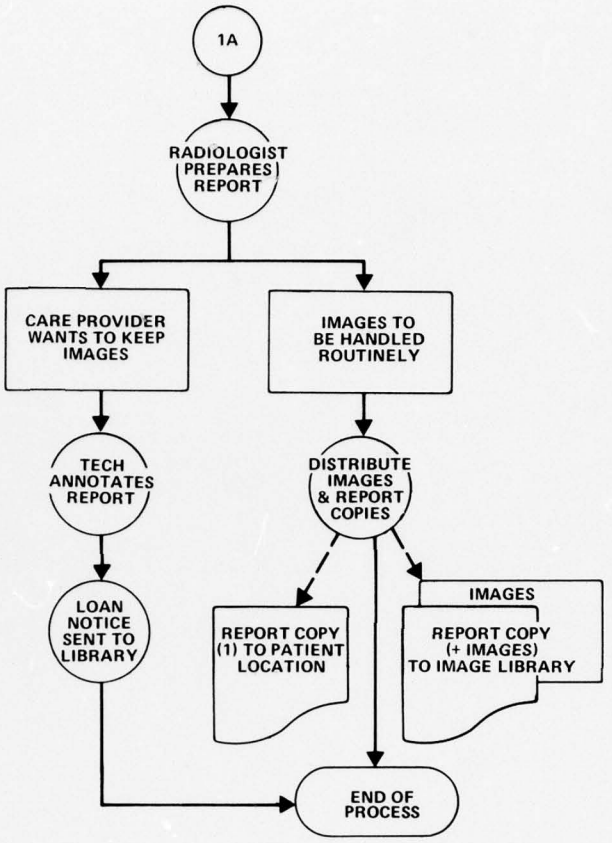


RADIOLOGY SUBSYSTEM
CAST ROOM /SURGERY SUPPORT PROCESS
SHEET 1 OF 1 5 DEC 75



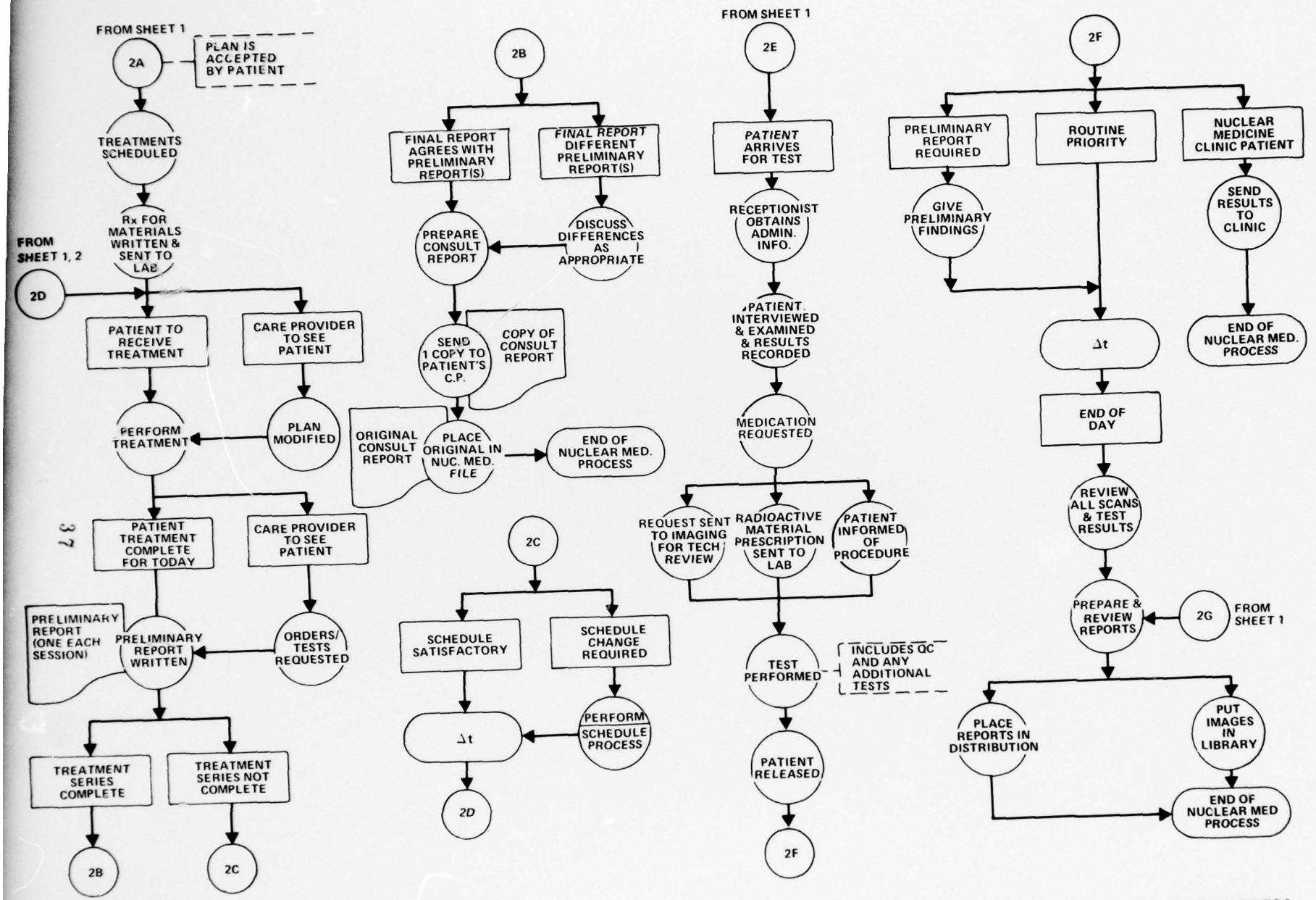
RADIOLOGY SUBSYSTEM
NUCLEAR MEDICINE PROCESS
SHEET 1 OF 2 5 DEC 75



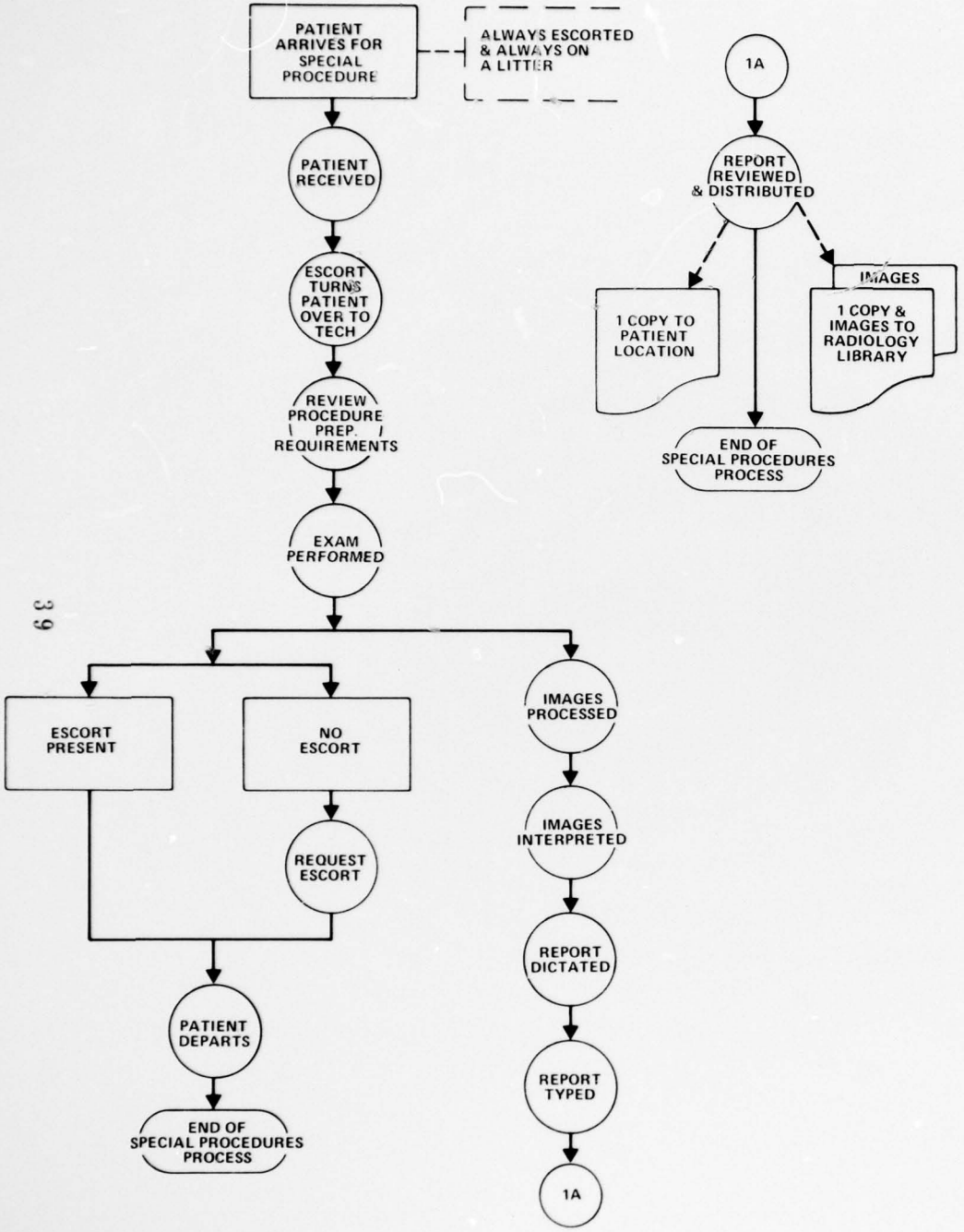


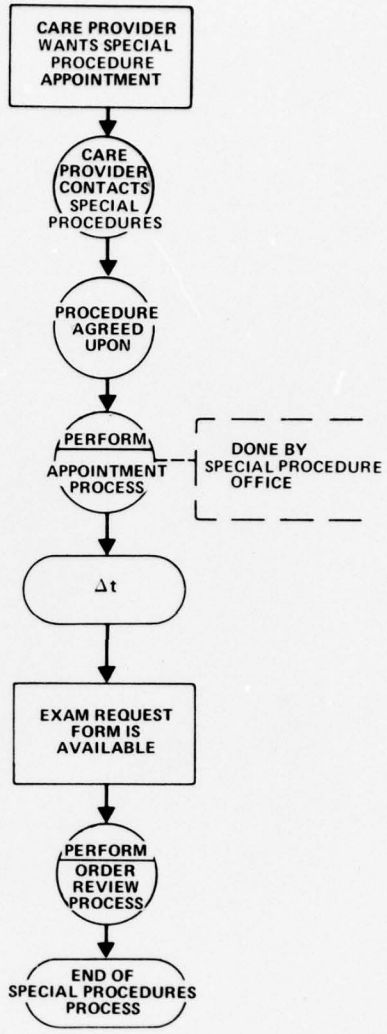
NOTE: 1 TECHNICIAN & 1 RADIOLOGIST ON DUTY, EACH ASSIGNED ON A ROTATIONAL BASIS TO THE X-RAY AREA IN EMERGENCY.

RADIOLOGY SUBSYSTEM
EMERGENCY ROOM PROCESS
SHEET 1 OF 1 5 DEC 75

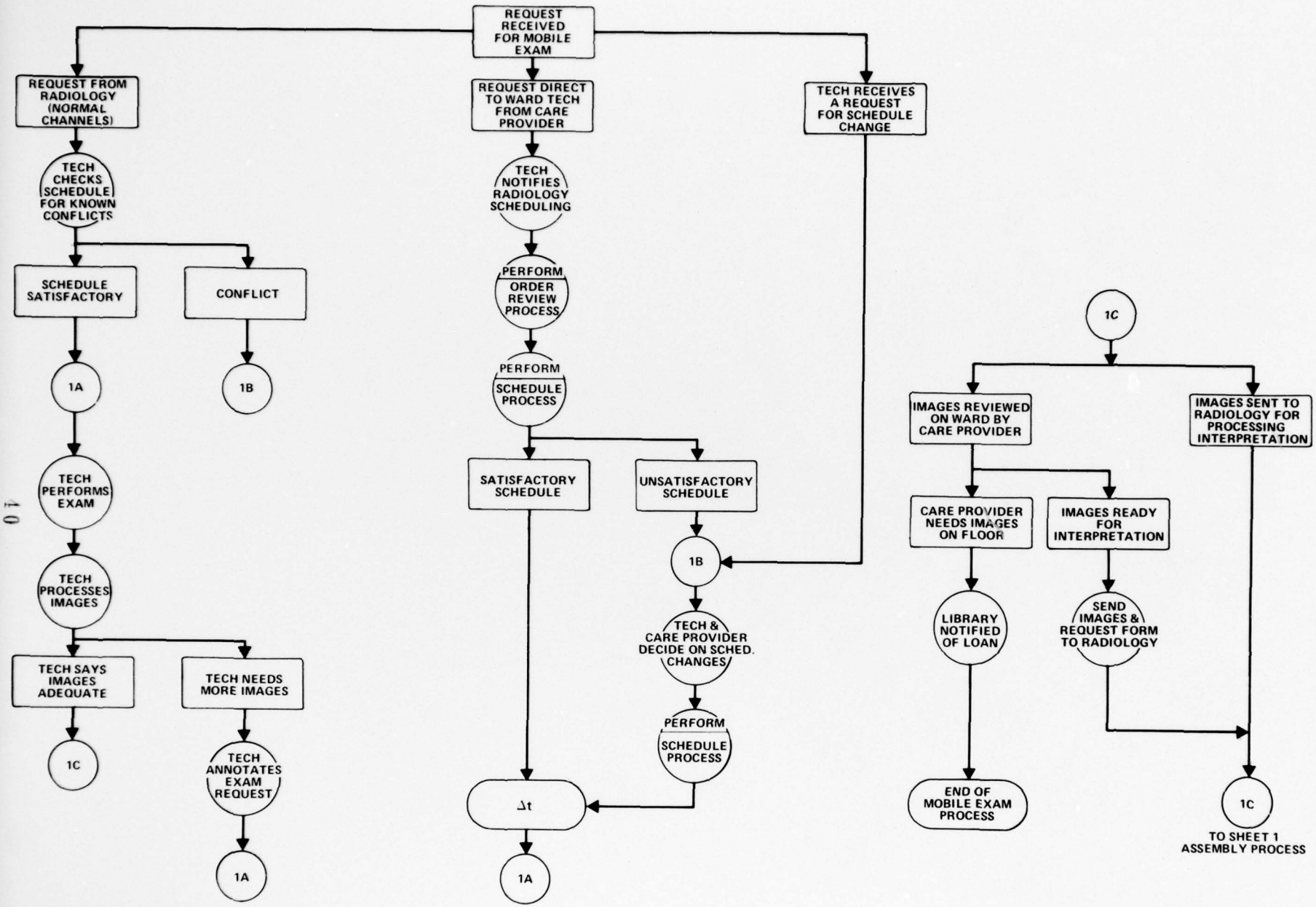


RADIOLOGY SUBSYSTEM
NUCLEAR MEDICINE PROCESS
SHEET 2 OF 2 5 DEC 75





RADIOLOGY SUBSYSTEM
SPECIAL PROCEDURES PROCESS
SHEET 1 OF 1 5 DEC 75



RADIOLOGY SUBSYSTEM
MOBILE EXAM PROCESS
SHEET 1 OF 1 5 DEC 75

INDEX TO CHARTS

Process	Page
Appointment	18
Cast Room/Surgery Support	35
Emergency Room Process	38
Examination	22
Exit	25
Image Assembly	26
Image Management	28
Mobile Exam	40
Nuclear Medicine	36
Order Review	21
Overview	13
Radiation Therapy	32
Reception	14
Results Reporting	27
Schedule	20
Special Procedures	39